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SEP 14 1948

Annual Meeting, Green Lake, Wisc. Sept. 13–16, 1948.

Contents

Excise Taxes and Economic Stability ..... *Frederick V. Waugh* 399

The Efficiency and Stability of American Agriculture ..... *Walter W. Wilcox* 411

Iranian Agriculture—Present and Prospective ..... *A. G. Black* 422

Production Costs as Criteria of Resource Allocation and Policy ..... *Ronald W. Jones* 443

Characteristics of the Marginal Cost Curve ..... *W. E. Paulson* 467

A New System of Farm Accounting ..... *A. L. Jolly* 500

Impact of the War on United States Flour Consumption ..... *William O. Jones* 518

Agriculture and History ..... *Rodney C. Loehr* 537

The Objectives and Methods of Agricultural Economics ..... *Bushrod W. Allin* 545

Discussion: Agricultural Economics and History ..... *Wilbur H. Glover* 553

Discussion ..... *Theodore Saloutos* 555

THE AMERICAN FARM ECONOMIC ASSOCIATION

Volume XXX AUGUST, 1948 Number 3

Contents (*continued*)

Notes

Estimating Cash Considerations in Real Estate Transfers from Internal Revenue Stamps ..... *Norman Nybroten* 558

Can Sufficient Private Credit Be Obtained for FHA Insured Farm Real Estate Loans? ..... *Clyde E. Stewart* 561

Relation of Feed, Labor, and Other Costs to Butterfat Test ..... *L. F. Miller and Homer J. Preston* 566

Inverse Carrying Charges in Futures Markets ..... *Roland S. Vaile* 574

Problem Research ..... *V. Webster Johnson* 576

Relationship of Land Values to Warranted Values, 1910–48 ..... *Harold C. Larsen* 579

Pricing of Production Credit to Farmers ..... *Norris T. Pritchard* 588

Book Reviews

Farm Accounting and Management by Ford Sturrock ..... *S. A. Engene* 592

A Critical Review of Research in Land Economics by Leonard A. Salter, Jr. ..... *R. R. Renne* 593

The American Individual Enterprise System: Its Nature, Evolution and Future by the Economic Principles Commission of the National Association of Manufacturers ..... *O. H. Brownlee* 596

Open Markets by Vernon A. Mund ..... *Adlowe L. Larson* 599

America's Sheep Trails: History, Personalities by Edward N. Wentworth ..... *W. H. Glover* 602

Land Economics, by Ronald R. Renne ..... *Raymond J. Penn* 604

Publications Received 607

Books Contributed to the American Farm Economics Association Library 608

News Items 609

Price: $5 per year, this issue $1.25

Entered as second class matter at the post-office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P. L. & R., authorised November 27, 1931.

JOURNAL
OF
FARM ECONOMICS

VOL. XXX August, 1948 No. 3

EXCISE TAXES AND ECONOMIC STABILITY

FREDERICK V. WAUGH*
Council of Economic Advisers, Washington, D. C.

IN 1933, at the depth of a major depression, taxes were imposed upon many farm products in the United States. The tax revenue provided funds for benefit payments to farmers. The combined tax-benefit payment program was intended to increase farm income, and, incidentally, to raise retail food prices.

In 1947 and early 1948, at the height of an inflationary boom,[1] and with rising food prices an important inflationary factor, several new proposals have been made for food taxes—with or without subsidies. Some of these proposals were intended to accomplish special purposes, such as the saving of grain in order to increase foreign aid shipments. For example, a tax on heavy hogs and a subsidy on light hogs has been suggested as a means of saving grain. In this paper we shall be concerned only with taxes (with or without subsidies) for the purpose of bringing about appropriate adjustments in prices, producer incomes, and consumer expenditures.

To make the problem more concrete we shall mention two recent proposals. Modigliani, Hart, and Neisser[2] have proposed an excise tax on meats and a "cost-of-living bonus" to consumers, for the purpose of reducing the cost of food to the consumer. Shepherd[3] has

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* The views expressed in this paper are entirely those of the author, and do not in any way reflect the views of the Council of Economic Advisors.

[1] *Midyear Economic Report of the President*, July 21, 1947, pp. 38–40; *The Economic Report of the President*, January 14, 1948, pp. 34–44.

[2] Letter to the *New York Times*, December 21, 1947.

[3] Geoffrey Shepherd, *Agricultural Price Policy*, Ames, 1947, pp. 395–496, and "A Farm Income Stabilization Program Could be Self-financing," This JOURNAL, Feb. 1948.

proposed excise taxes on all farm products in periods of high prices in order to provide funds to pay benefits to farmers during periods of low prices and thus help to stabilize farm income. Johnson[4] has proposed a tax upon all foods and a per capita subsidy to consumers in times of inflation, and a subsidy to farmers in times of depression. Thus the Johnson proposal includes features of the other two.

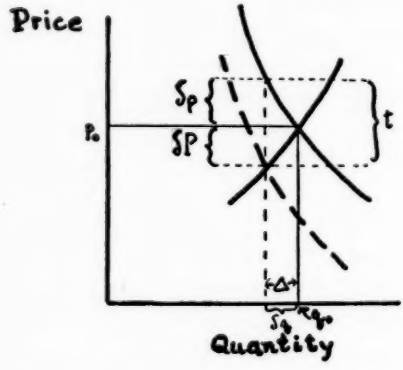
We shall not analyze any of these proposals in detail but shall discuss some of the general principles that determine the adjustments in prices, incomes, and expenditures that can be expected as a result of tax (or tax-subsidy) programs.

Specifically we propose to show that under certain simple and fairly realistic conditions an excise tax on some particular foods would reduce the cost of living index.

I

Independent Goods

If the supply of and demand for the taxed food are entirely independent of prices of other goods, the price effects of the tax are fairly obvious. In such cases the following simple diagram is valid.



With no excise tax, and with competition, q_o will be produced and bought at the price p_o. With a tax of t cents a unit the amount produced and consumed is reduced by δq; the price to consumers is raised by δp and the price to producers is reduced by δP.

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[4] D. Gale Johnson. "The High Cost of Food—A suggested solution," *The Journal of Political Economy*, Vol. LVI, Feb. 1948, p. 54.

It is easy to see that the changes in prices and quantities resulting from the tax depend upon the size of the tax and upon the relative slopes of the demand and supply functions. If the slopes of the demand and supply functions are $-a$ and b at the point (q_o, p_o), the tax, t, will raise the retail price by approximately

$$\delta p \simeq \frac{a}{a+b} t \tag{1}$$

It will lower price to producers by approximately

$$\delta P \simeq \frac{b}{a+b} t \tag{2}$$

It will reduce production and consumption by approximately

$$\delta q \simeq \frac{t}{a+b} \tag{3}$$

Measures (1), (2), and (3) are only approximate because they neglect the possible curvature of the demand and supply functions.

This elementary analysis is doubtless well-known to the reader. It is repeated here because it has a bearing upon many current proposals.

Shepherd suggests that in periods of high prices a special tax be imposed upon farmers. He calls these "income taxes," but says that "the tax should be so much per unit of sale—$5 per 100 pounds (of hogs), for example, perhaps 6 cents per pound of cotton, etc." Presumably all agricultural products would be taxed in periods of high prices. Benefit payments would be made to farmers in periods of low prices. Presumably, these would be in the form of bounties (negative taxes) on all farm products.

The purpose of Shepherd's proposal is to help stabilize the prices and incomes received by farmers. This doubtless would be accomplished. But what would happen in the rest of the economy? Would not such taxes raise the cost of living still further in inflationary times like the present, and drive them still lower in periods of deflation like the 1930's? If so, farm income would be partly stabilized at the expense of still greater instability in the rest of the economy. With retail food prices already high, and rising, in the winter of 1947–48, and with labor unions asking wage increases to cover higher food costs, it would seem an inappropriate time to impose new taxes upon foods.

Shepherd answers this by saying that "agricultural production as a whole is very inelastic, and a tax applied to all farm products during booms would not appreciably reduce agricultural production as a whole" and thus that "the price to farmers would be lowered by practically the full amount of the tax . . . , and prices to consumers would also remain practically unaffected."

In other words, Shepherd assumes that the constant, b, in equations (1), (2), and (3) is very large. Unless the constant, a, is also very large this would, as Shepherd says, mean that the tax-bounty arrangement would not affect retail prices *very much*. But the fact remains that, unless the supply of farm products is absolutely fixed, the tax-bounty proposal would aggravate the general problem of price instability by forcing retail food prices somewhat higher in periods of inflation, and by forcing them somewhat lower in periods of deflation. Possibly the stability of farm incomes might be important enough to warrant consideration of Shepherd's proposal even at the expense of introducing greater instability in the rest of the economy, unless farm income could be stabilized without this unfortunate result. However, we shall show later that a simple change in his proposal would avoid the unstabilizing effect upon retail prices.

The Modigliani-Hart-Neisser proposal has also been criticized on the grounds that a meat tax this year would force retail meat prices to still higher levels.[5] Mr. Draper says that such a tax "would further discourage production . . . and therefore actually accentuate the meat price problem."

To this Modigliani (in correspondence with the writer) has two answers. First, he doubts whether meat production this year would be discouraged much by the tax. Second, consumers would be fully protected by the payment of a cost-of-living bonus financed by receipts from the meat tax.

Again, the discussion hinges upon the slope of the supply function of the taxed commodity. The writer believes that the immediate effect of a meat tax might be to encourage liquidation of animals and an increase in meat supplies; but that over a period of six months or a year such a tax would reduce meat supplies somewhat. The reduction might be slight, and therefore meat prices might not be increased much in the short run.

[5] Norman Draper, American Meat Institute. Letter to the *New York Times* December 26, 1947.

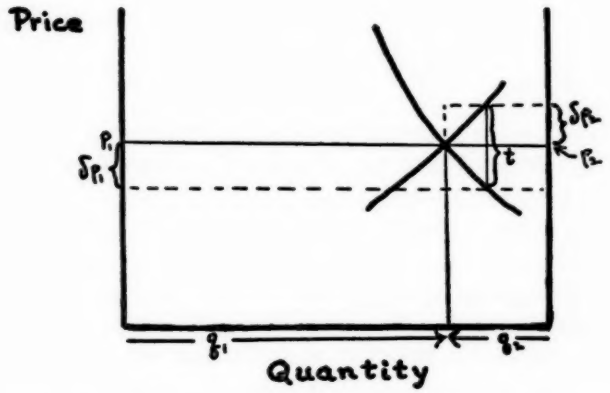
But this is not the best defense of a meat tax in times of high food prices. It is quite possible that a meat tax might actually lower the cost of living—entirely aside from any cost-of-living bonus. This is possible only because the supply of meat is not independent of supplies of other foods, such as bread, flour, milk and eggs. We must therefore, consider the problem of related supplies.

II

Fixed Supplies of Raw Materials

Let us consider the case of a fixed supply of a raw material that is used to make two or more consumer goods. We shall show that a tax imposed on the goods with the more elastic (or less inelastic) demand will tend to reduce the cost-of-living index.

The following diagram illustrates the situation. It is assumed that the demand functions for the two goods are independent, but that the supply of the two together is fixed in terms of raw materials. Thus, $q_1+q_2=Q$, where Q is the fixed length of the base line. The quantities and prices of each commodity are in terms of units of the raw material.



An excise tax of t cents on each unit of q_2 will, under conditions of competition, bring about a retail price differential of t cents. Some of the raw material formerly used in making q_2 will be shifted to the production of q_1. The changes in price are δp_1, and δp_2. The income of producers will be reduced by $Q\delta p_1$. Government revenue from the tax will be $t(q_2-\Delta)$, where Δ stands for the amount of material shifted from q_2 to q_1.

The cost of living index is taken as 100 in the "base period" before the tax was imposed. After taxes it becomes

$$I^{(t)} = \frac{q_1(p_1 + \delta p_1) + q_2(p_2 + \delta p_2)}{q_1 p_1 + q_2 p_2} \cdot 100 \tag{4}$$

The index is reduced if

$$q_1 \delta p_1 + q_2 \delta p_2 < 0 \tag{5}$$

The two products to the left of the above inequality can be easily identified in the diagram.

Since before the tax $p_1 = p_2$ and since $\delta q_1 = -\delta q_2 = \Delta$, we can derive from (6)

$$\frac{q_1 \delta p_1}{p_1 \delta q_1} - \frac{q_2 \delta p_2}{p_2 \delta q_2} < 0 \tag{6}$$

This means that the index is lowered as a result of the tax if

$$-\frac{1}{e_1} + \frac{1}{e_2} < 0$$

or

$$e_2 > e_1 \tag{7}$$

where e_2 and e_1 are approximate measures (not allowing for curvature of the demand functions) of the elasticity of demand for q_2 and q_1 with respect to their prices.

Thus, a tax upon the more elastic good tends to reduce the average price of the two commodities together, following the usual cost-of-living formula with weights in the base period before the tax. Assuming that the tax does not affect prices of other goods, this means a reduction in the total cost-of-living index.

This is more than a technical gain. It is generally recognized[6] that a reduction in the cost of living index as measured by (4) necessarily means a real gain to any consumer whose purchases of q_1 in the base period represented as great, or greater, a percentage of his total purchases of q_1 and q_2 as did the purchases in the total market. Such a consumer could, after the tax was imposed,

[6] Harold T. Davis, *The Theory of Econometrics*, Bloomington, Indiana, 1941, pp. 333–335.

buy the same amounts as before at a lower cost. The opportunity to shift to a still more favorable position is a further gain, allowing him to reach a higher point on his indifference surface.

It is also fairly easy to see from the diagram that consumers' surplus would be increased, and that total expenditures of consumers would be reduced by the tax we have described. Producers' incomes would be reduced still more, since government taxes would absorb part of the money spent by consumers.

This simple case appears to be fairly realistic—at least for short periods of time—when dealing with foods. The total amount of grain available for domestic consumption in the United States from July 1947 through June 1948 was practically fixed. The 1947 crop had been harvested and the carryover from previous crops could not be altered. The amounts for seed and for foreign aid were almost inflexible. Even the carryover into next year had been set by the Congress.[7] Thus, we had a fixed amount of grain for domestic consumption. However, there is substantial flexibility in the amounts used for specific purposes. Grain is used for human food, for animal feed, and for various industrial purposes. The animal feed is used to produce meat, dairy products, and eggs.

It is generally believed that the demand for meat is much more elastic than the demand for bread and flour. Probably this is true not only in terms of retail prices of meat and bread, but also in terms of the returns to the farmer for wheat sold to millers, or of returns for wheat fed to meat animals. The writer has not attempted to verify this by statistical analysis. Assuming it to be true, however, a tax upon meat would lower the cost of living. Even without a bonus most consumers would be better off. They would pay more for meat, but would be more than compensated by lower prices of bread, flour milk, butter, and eggs. The only consumers to be hurt would be those who buy large amounts of meat and small amounts of the other foods mentioned.

Obviously there would be a further gain to consumers if the tax revenues were used to finance some form of consumer benefits. Such benefits might take the form of a cost-of-living bonus, such as that proposed by Modigliani. Or it might take the form of a negative tax (bounty) upon bread or milk.

We have seen that excise taxes might be used in a period of in-

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[7] Interim Aid Bill, P.L. 389.

flation as a means of lowering the cost of living to the consumer, and as a means of reducing an excess purchasing power of producers. Could we use similar techniques to increase producer incomes during periods of deflation? With fixed supplies of raw materials any system of excise taxes will reduce the incomes of producers. Yet we might consider four possible combinations of taxes and subsidies.

First, in a period of low prices we might tax the less elastic commodity (bread) and use the tax revenues to make income payments to farmers. Our analysis shows that in this case the reduction in producers' incomes on account of the tax would be less than the government revenue from the tax.

Second, we might tax the less elastic commodity (bread) and subsidize the more elastic commodity (meat). A self-financed system of this kind would raise producers' incomes.

Third, we might tax the more elastic commodity in periods of inflation and subsidize (by a negative tax) the same commodity in a period of deflation. This also could be self-financing. The tax revenues in an inflationary period could be impounded and used to finance subsidies in a deflationary period. This assumes that supplies of the raw material are fixed in each separate period. It does not assume that the tax in the inflationary period would not affect output in a later period of deflation.

Fourth, the tax revenues collected during a boom might be used to finance a program to improve the diets of low-income families during depressions. Such a program might be similar to the former Food Stamp Plan, or it might follow the pattern of Senator Aiken's Food Allotment Bill.

Any of these four programs would help to stabilize both producers' incomes and consumers' living costs. This does not necessarily mean that any of them would be acceptable either to producers or to consumers. The producers of the taxed commodity might well object on the grounds of unfair discrimination. Consumers might find it difficult to understand how they were helped in a period of high prices by a meat tax that pushed meat prices still higher. Because of these very real difficulties the writer is not prepared to *advocate* tax and subsidy measures such as those described. Yet in the absence of more direct methods of price control there would appear to be some merit to the use in critial periods of the kinds of excise taxes and bounties we have described.

III

Varying Supplies

In the preceding section we considered a very special case: that of fixed supplies of a raw material, such as grain. The reader may well object that such a situation would be extremely rare, if in fact such a situation ever exists. Perhaps even the total domestic supply of grain for use in the 1947–48 crop year would be affected somewhat by a change in prices. For example, a higher price of wheat might lead to more effective measures against rat damage and other forms of waste. Also, supplies are never fixed permanently. If taxes were to be imposed for periods longer than a year we would need to consider their effects upon the total amounts of goods produced and consumed. Thus, a tax upon meats might result in lower average retail food prices the first year; but it might also result in reduced production and higher prices the following year.

What can we say about the effects of excise taxes upon the prices of a group of commodities when the total supply is not fixed? If the supply of, and the demand for, each goods are entirely independent of the prices of other goods, we have the simple situation described in Section I. A tax upon any commodity raises the retail price of that commodity; does not affect prices of the other commodities; and thus raises the cost of living. But in many cases the supply of, and the demand for, one commodity are affected by prices of several related commodities. In such situations it is not at all unlikely that a tax upon one commodity may lower the average retail prices of the group of related commodities.

In fact, Hotelling[8] demonstrated that in certain possible circumstances a tax imposed upon one commodity might lower the retail prices both of the taxed commodity and of competing commodities. For example, it is possible that a tax upon meats might reduce the retail prices both of meats and of bread. This is true both under conditions of monopoly and under conditions of competition. Hotelling presented an elegant analysis of this problem and developed mathematical conditions that would assure such a lowering of prices as a result of a tax.[9] He concludes that, in the case of competition "necessary, though not sufficient, conditions for this

[8] Harold Hotelling, "Edgeworth's Taxation Paradox and the Nature of Demand and Supply Functions." *Journal of Political Economy*, Vol. XL, 1932, pp. 577–616.

[9] *Op. cit.*, p. 601.

are that the commodities compete both in consumption and in production." As Hotelling uses the term, two commodities "compete in consumption" if an increase in the supply of the first commodity lowers the price of the second; they "compete in production' if a larger output of the first commodity raises the marginal cost of producing the second. When two commodities compete in both ways it is possible that a tax upon one of them may lower the retail price of each.

In a general way we can say that the demand for and supply of many commodities probably fulfill the necessary conditions stated by Hotelling. As he noted, these necessary conditions are probably met by many agricultural products. But statistical measurements of joint supply and demand functions are not yet accurate enough to test whether the necessary and sufficient mathematical conditions are met in a wide variety of cases.

Obviously the cost of living index would be lowered in any case that met the Hotelling test—since prices of all related goods would drop as a result of the tax. In many other cases a tax upon one commodity would lower some prices and raise others and result in a lower index. A necessary condition is that the commodities compete (in the Hotelling sense) in consumption, in production, or in both.[10] The result is more likely if they compete both in consumption and in production.

In the present state of statistical knowledge we can only say that the necessary conditions doubtless are met in many practical cases. It is thus possible that in many cases a tax on one commodity may tend to lower the general level of living costs. But, unless total supplies are fixed, we can not demonstrate that this would happen in any given case until we have accurate measures of the degree of "competition" in production and in consumption.

IV

Income Taxes vs. Excise Taxes

In view of the above analysis it would appear that excise taxes and bounties might be used to help stabilize both the cost of living

[10] Necessary and sufficient conditions can be stated as follows: Let ϕ_{ij} be the flexibility of price (reciprocal of the elasticity of demand); and let ψ_{ij} be the flexibility of marginal cost of production (reciprocal of the elasticity of marginal costs). Then the average price of two commodities will be lowered by a small tax upon the first if

$$(\phi_{12}+\phi_{22})(\phi_{12}-\psi_{12})>(\phi_{11}+\phi_{12})(\phi_{22}-\psi_{22}).$$

of consumers and the incomes of producers. This would require a discriminative use of the taxing power. If there were no discrimination—that is, if all goods were taxed during inflation and subsidies given during deflation–producers' incomes might be more stable, but the cost of living would be less stable.

In the writer's opinion there is real merit in proposals, such as Mr. Shepherd's, to finance at least a part of farm benefit payments by taxes that are paid, directly or indirectly, by the farmer himself. There is merit in reducing the violence of fluctuations in prices at the farm level. But we should avoid any measuers that are likely to increase the violence of price fluctuations at the retail level. The danger of a general excise tax upon all farm products is that it would make retail food prices even higher during inflation and even lower during deflation.

It is hardly enough to say that the additional price fluctuation would be small, because total farm output is *practically* fixed. The movement would be in the wrong direction.

To the writer the answer is a tax upon net farm income, in place of a tax of so much a unit produced or sold. Mr. Shepherd[11] seems to argue that an income tax would have the same price effects as an excise tax. He writes, "A sales tax during booms would lower agricultural prices relative to other prices and reduce the incentive to agricultural production, as you say. But an additional income tax would have the same incentive-reducing effect. Both taxes would reduce the reward for production "

The writer disagrees with Shepherd on this point. True, both taxes would reduce the reward for production. But we should not expect them to have the same effects upon output. Assume that without any tax the market price of hogs is $25 a hundred pounds. Each hog producer will find it most profitable to produce up to the point at which the marginal cost of production is $25 a hundred pounds. If the cost of producing a few more hundredweight of hogs is $24, and the price is $25, he will produce a few more hundredweight. If he must pay a tax of, say 10 percent or 50 percent, on net income, it will still be to his advantage to produce the additional amount.

The situation would be different with an excise tax of, say $5 a hundred pounds. Whether the tax were paid originally by the farmer

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[11] Letter of December 3, 1947 to the writer.

or by the consumer, such a tax would reduce prices at the farm by $5, unless production were reduced. But, the point is that marginal production would be stopped. Hogs that cost $24 would not be produced at a net price of $20 at the farm. Some new equilibrium would be reached with farm prices higher than $20 and the price plus tax higher than $25, and with hog production at a lower level.

The situation would appear to be much the same if excise taxes were imposed upon all agricultural products without discrimination. Probably such a system of taxes would tend to reduce the output of each commodity.

An additional tax on net farm incomes in periods of inflation and some form of income payments to farmers in periods of deflation would help stabilize farm incomes without seriously adding to fluctuations in the cost of living. However, a special additional tax upon net incomes of farmers alone—with no corresponding tax upon other incomes—might cause some shift of marginal farmers to other occupations. To some degree, then, this would have the same disadvantage as the excise tax.

The writer believes that a tax upon net farm income would be far better than a general system of excise taxes on farm products. But it would be still better to apply the same principle to all income taxes; raising the rates in times of inflation and lowering them in times of deflation. It is true that this is especially important to agriculture because agricultural prices and farm incomes fluctuate more widely than do prices and incomes in most other parts of the economy. Yet greater stability is important in all industries. It could be accomplished without adjusting tax rates if we all were able, and sensible enough, to save in prosperoustimes and to spend our savings during depressions. Until we are wise enough to do this, we might well ask our government to do it for us.

THE EFFICIENCY AND STABILITY OF AMERICAN AGRICULTURE

WALTER W. WILCOX
University of Wisconsin

TWO informative and thought provoking papers dealing with this subject appeared in the August and November 1947 issues of this JOURNAL.[1] Professor Schultz in the first of these two papers reached the conclusion that "American agriculture by and large is very inefficient. It (agriculture) does not approach the standard of economic efficiency set by the American economy." Analyzing the problem of economic stability in agriculture in the second article, he found "The very uneven distribution of income over time is still (an) acute problem in agriculture." In the closing paragraphs he states, "Income stabilizing programs are too heavy a burden for the pricing system to bear . . . production control is not an appropriate (remedy) . . . it will be necessary to find ways and means for transferring income to farmers during periods when aggregate demand becomes depressed." This paper examines several of the issues presented in these papers from additional points of view.

Let us first re-examine the efficiency of agriculture as compared with the rest of the economy. Agriculture is operating at less than optimum efficiency. There can be no disagreement on this point, but to marshall data which will accurately quantify the current situation is a well nigh impossible task. Mr. Schultz in his selection and use of data presents a quantitative picture which is further out of focus than may appear on first consideration. The data exaggerate the implied inefficiency in agriculture.

Figures presented for 1939 show the value added per employee per year in manufacturing to be $2762 in contrast to value added in agricultural production per man equivalent of $867. A footnote (13) mentions "that the whole economy was running in low gear" in 1939 with several million workers unemployed. The implication of this situation largely invalidates the comparison made. This is true for two reasons. First, farm prices were abnormally low in 1939 because total farm output had not been reduced although a substantial part of the non-farm working force (approximately 20 percent) was unemployed and had little purchasing power.

[1] "How Efficient Is American Agriculture" and "The Economic Stability of American Agriculture," by T. W. Schultz.

Second, the number of workers on farms was higher and physical production per worker lower than under full employment conditions as a result of unemployment backing up on farms. Thus efficiency measured in physical terms was abnormally low and the products sold at distressed prices because of unemployment. Value of product per employee in manufacturing in 1939 was relatively high because output was limited to the quantity which would sell at established prices. Unneeded workers (over three million) were shifted to government relief rolls and not counted as a part of the labor force in manufacturing. Between 1939 and 1946 farm output per worker has increased about one-third and value of product per worker has increased 300 percent. During this period wages per employee in manufacturing increased 184 percent and it is doubtful whether value of product increased as much as wage rates in percentage terms.

Other Industry Comparisons

Questions may also be raised regarding the appropriateness of comparisons between agriculture and manufacturing as a measure of the relative efficiency of agriculture. Increased employment in manufacturing is not an alternative to farming to any significant extent. In 1939 only 30 percent of the working force outside agriculture was employed in manufacturing industries. Viewed in historical perspective, until the war period the proportion of the nonagricultural working force employed in manufacturing was declining each year.

Reviewing changes in the structure of production from 1870 to 1935, the National Resources Committee reported that, "The areas of expanding employment have been in the rendering of direct services in the field of trade and in the fields of government and finance . . . . In respect to the changing character of production through time, after adjustment for depression influence, there are two most striking characteristics. First, there is the tendency for a decline of employment in the extractive segments, agriculture and mining, the lack of any significant postwar trend toward expanding employment in manufacturing and in utilities as a whole, the contraction of railroad employment counterbalancing expansion in the other utilities and the trend of expanding employment in trade, service to the consumer, and in the field of government and finance. . . . "[2]

[2] *The Structure of the American Economy*, Part I, National Resources Committee, Government Printing Office, Washington, D. C., 1939, pp. 64 and 78.

During the war period there was a reversal of this trend with a relative gain in manufacturing and loss in employment in services to consumers, but there was a further relative increase in employment in government and government enterprises. No doubt Mr. Schultz made comparisons between agriculture and manufacturing because of the difficulty of arriving at the value of product for workers in other industries. In the absence of value of product data for other industries it may be profitable to speculate on the marginal productivity of labor in other fields of employment. The Survey of Current Business published the following data on employment and wages by industries for 1946.[3]

Industry	Number full time equivalent employees	Average earnings per full time equivalent employee
	(000)	
Transportation	2,850	$2,937
Mining	888	2,677
Contract Construction	1,637	2,581
Finance, Insurance, Real Estate	1,507	2,567
Communications and Public Utilities	1,103	2,560
Manufacturing	14,471	2,512
Wholesale and Retail Trade	8,227	2,392
Government and Government Enterprises	8,897	2,346
Services	5,309	1,842
Agriculture (hired)	2,148	1,181
All Industries	47,147	2,357

Similar data for 1939 show approximately the same relationships in relative wages. Finance and transportation workers had the highest annual earnings in 1939 and were near the top in 1946. The two expanding areas of employment—Services and Government—were near the bottom in both years. Differences in labor union organization, wage, and apprentice policies affect the relation of earnings to marginal productivity of labor among industries. Yet the wide difference in earnings in the Service and Manufacturing industries must be in part a reflection of differences in marginal productivity of labor in the two uses.

It would appear more appropriate to compare the efficiency of workers in agriculture with workers in the Service industries rather than with those in manufacturing. This is especially true when one considers that much of the increase in employment associated with

[3] *Supplement on National Income*, July 1947, Tables 24 and 26.

migration from farms in recent decades took place in either the Service industries or government. As a matter of fact throughout most of the thirties, a job in the Service industries or a place on W.P.A. rolls were about the only alternatives open to most people living on farms.

Labor Force Comparisons

Efficiency comparisons between agriculture and other industries are complicated by differences in the nature of the labor force. Farming is a way of life as well as a business. A relatively high proportion of farm operators are older men. These men are counted as a part of the labor force in agriculture, yet they are individuals who would be living on old age pensions if they had spent their active lives in nonfarm work. A few of these older farmers who get counted in the agricultural labor force are in fact individuals retired from other occupations. Accurate measurement of relative efficiency would require comparable treatment of the older men in both industries.

At the other end of the age scale farm boys and girls help with the work on the farm before they are old enough to work for other people for wages. They are a part of the labor force in agriculture. The alternative for these farm boys and girls is playing marbles or baby sitting in the urban community rather than working in a manufacturing plant. Unpublished data from the Bureau of the Census and the Bureau of Agricultural Economics indicate that 22 percent of the farm workers in recent years are 17 years of age or younger, and 6 percent of the workers are over 65. These two groups contribute about 20 percent of the man equivalents employed in agriculture.

1946 Comparisons

If in spite of these difficulties the same type of comparison is attempted in 1946 as was made in 1939, one gets results of the same general character but of a far different magnitude.[4] Value added per man equivalent in agriculture calculated on the same basis as in 1939 increased from $867 to $2592 in 1946.

Gross production per worker is about one-third above the na-

[4] Farm prices averaged 21 percent above parity in 1946. A recent B.A.E. long term outlook statement estimates that with a high level of employment they will average parity in the next 10 to 15 years. Thus 1946 may overvalue agricultural output relative to industrial output by approximately 20%.

tional average in the northern and western states. In contrast it is only 60 percent of the national average in the southern and southeastern states. Thus the value of product added per worker was around $3450 in 1946 in the northern states and $1550 per worker in the southern states.

Rough calculations indicate that the value of capital, including land, associated with each worker in agriculture may be substantially higher than the capital used per employee in manufacturing. Capital used per man in the two industries in 1935 was estimated to be $3900 for agriculture and $3700 for manufacturing by the National Resources Committee.[5] Since 1935 capital values per worker are believed to have increased more in agriculture than in industry as a result of sharp increases in livestock, feed and farm real estate prices. After making a deduction for interest on capital used per worker in agriculture of $300 (a round figure arrived at by assuming an interest rate of approximately 4 percent) on the average investment of $7400 per worker, we find workers in agriculture had a net value of product of around $2300 in 1946 vs. average employee earnings in all industries of $2357. This is substantially higher than the earnings of employees in the Service industries and only $200 to $300 below the earnings in manufacturing and other high wage rate industries. After allowing a higher deduction for use of capital per worker in the northern and western states, agricultural workers in these states earned around $2950 or as much as the employees in the highest paid industries.

Efficiency in Commercial Agriculture

Compilations by Ducoff and Hagood[6] permit the segregation of value of product per man equivalent worker on the commercial and non-commercial farms in 1939. The average value of products

[5] *Op. cit.*, p. 63. Their estimates of capital used per man for the different industries were as follows:

Public Utilities	$11,900
Mining	8,700
Agriculture	3,900
Manufacturing	3,700
Services to the Consumer	3,700
Trade	2,000
Crude Average for Entire Economy	4,600

Ducoff and Hagood in mimeographed report published by the Bureau of Agricultural Economics in 1944 estimated capital investment per worker in agriculture in 1939 at $4,220. Similar data for 1946 indicate a capital investment of $7,400 per worker in agriculture.

[6] *Ibid.*, 1944, Bureau of Agricultural Economics, Mimeograph Table 4.

per man equivalent worker in 1939 was $951, but 52 percent of the farms employed 66 percent of the man equivalent workers, produced 89 percent of the total value of product, and had a value of product per man equivalent worker of $1280. The remaining 48 percent of the farms employed 33 percent of the workers, produced 11 percent of the total value of product, and had an average value of product per man equivalent worker of only $306.

Thus if we are interested in worker efficiency in the commercial segment of agriculture in 1939 we find that the value added per man equivalent on the 52 percent of the farms which produced 89 percent of the product was around 35 percent above the average which included all self sufficing farms. Similar data for 1946 indicate value added per man equivalent on these commercial farms is $3473 or approximately the same as the estimate for the farm workers in the northern states (and favorable relative to non-farm workers).

Long Term Trends in Efficiency Similar

The relative efficiency of agricultural and non-agricultural workers may also be examined from an historical perspective. Since 1910 production per worker in manufacturing and mining has increased more than production per farm worker, but during the last 15 years agriculture has kept pace with manufacturing and mining in increasing output per worker. Index numbers of production per worker (1935–1939 = 100) for selected years follow:[7]

Year	Gross farm production per worker	Production per worker in manufacturing and mining
1910–14	81	64
1920–24	93	75
1930–34	95	90
1940–44	123	130
1945	137	142

Similar computations of real income per farm worker and per industrial worker, 1910–1945, indicate that real income per farm worker has increased fully as much as real income per industrial worker over the years. The data (1935–1939 = 100) follow:[8]

[7] United States Department of Agriculture, Miscellaneous Publication, #630, Table 36.

[8] *Ibid.*, Table 56, Index numbers of real income per industrial worker are adjusted for unemployment.

Year	Real income per farm worker	Real income per industrial worker
1910–14	82	85
1920–24	72	100
1930–34	67	85
1940–44	165	159
1945	206	184

Institutional Barriers

Mr. Schultz is entirely correct in stating that "human effort, land and capital are poorly utilized in much of agriculture," but a great deal is already known about the causes for this poor utilization. It is impossible and unnecessary to attempt a complete statement of the known causes at this point. A few of the more crucial factors are lack of mechanization of cotton and tobacco production; inadequate education in rural areas, particularly in the south; poor diets and poor health of workers; excessive pressure of the population on the land in the less productive agricultural areas; monopoly in nonfarm industries; labor union policies which prevent free entry into other occupations; and inadequate family savings which limit migration from low income farms.

These are institutional barriers which to a large extent prevent the price system from achieving resource allocation in line with equilibrium analysis. In terms of the magnitude of the waste involved and the inefficiency in the use of resources introduced by these institutional barriers, they far exceed similar wastes and inefficiencies associated with government price stabilization measures. More attention needs to be given to ways and means of eliminating these institutional barriers to economic resource allocation.

Toward Greater Economic Stability in Agriculture

Mr. Schultz' paper on economic stability in agriculture demonstrates that total farm production has been exceedingly stable from year to year and that over-all income instability arises from changes in demand. This evidence serves as the background for his general proposals regarding the appropriate functions of the pricing system. These are "to guide the allocative decisions in agricultural production and channel farm products to consumers." He would improve the traditional free market pricing system by removing price uncertainty to producers through a system of government announced

forward prices. Products would be channelled into consumption at home and abroad more efficiently by freeing market prices, i.e., removing present government price supports for farm products.

While endorsing the current social goal of achieving more stability in agriculture two key dictums stated in his earlier writings are repeated. "Production control is not an appropriate means of counteracting adverse income effects of business depressions . . . ", and "Income stabilizing programs are too heavy a burden for the pricing system to bear if it is to function efficiently in guiding agricultural production and in channeling farm products to consumers." His alternative is to maintain farm income during business depressions by direct government payments.

These conclusions grow out of economic analysis starting from equilibrium assumptions which include full utilization of known technology, free competition and free mobility of resources both in farm production and in processing and marketing farm products. It is the present writer's position that while these proposals logically follow from the standard assumptions in economic analysis, other proposals may be more appropriate for dealing with the current instability problem in agriculture.

The case against production controls—that they lead to inefficient production and reduce food supplies available to consumers when they need cheap food—is weak when one examines United States experience in this field. The strongest case against production controls is that they largely failed to achieve any control, and there is little likelihood that Congress and farmers will support effective controls. The only reasonably satisfactory experience was with tobacco controls. Even here production was allowed to increase over the years. For most other products, increased production per acre and increased production of substitute products offset effects of acreage control restrictions. Experience with cotton was second to tobacco in terms of effective control, yet increases in synthetic fiber production and cotton production in foreign countries largely nullified any industry gains from controls.

Looked at in broad terms production control in the thirties gave results opposite to those expected. Because of their influence on correcting the existing lag in adoption of improved technologies and soil management practices, production controls stimulated increased production. Available statistics indicate that over-all production was not reduced in the short run. When one takes into

account the indirect effect of rebuilding soil fertility and considers the ten year period 1935 to 1945, there can be little question that production controls increased the efficiency of use of resources. Production controls should be avoided primarily because they are not likely to be effective for most products either in reducing instability or in maintaining and increasing the income to the industry. Furthermore they lead to undesirable political developments by placing too great a burden on our democratic institutions. But where a product such as tobacco has no close substitutes and the buyers or processors are limited to a few large concerns, production controls appear to be an effective method of reducing income instability to producers.

Mr. Schultz believes that the price system cannot carry the heavy burden of stabilizing farm income through time without interfering with its primary functions of allocating resource use in production and channeling farm products into consumption. When one looks at the functioning of the processing and marketing firms over the years and at the extremely sharp fluctuations in prices at the farm, one wonders about the efficiency of the price system in allocating production from year to year. Relatively constant and wide marketing margins cause sharp fluctuations in farm prices when small changes take place in either supply or demand. Mr. Schultz and others point to this inefficiency in our current market prices in making their case for a system of forward prices. The advocates of forward prices appear to have overlooked the fact that the one politically feasible method of lessening income instability at the present time is precisely in this field of using the price system to stabilize income through time. A system of price supports for storable commodities designed on economic bases using both price levels and storage supplies as criteria in setting loan rates, if effectively administered could accomplish three desirable objectives as compared to free market prices in our present highly monopolized economy:

1. Improve the efficiency of the price system in directing the use of resources, especially the feed grain livestock economy, minimizing undesirable year to year shifts in individual crops and livestock numbers.
2. Stabilize the flow of products to consumers to the extent that fluctuations arise out of year to year variation in supplies (not particularly important in over-all terms, but a stabilizing in-

fluence for meat, an important element in our standard of living).

3. Stabilize income to farmers from year to year.

Current legislation proposing loans on storable commodities at a percentage of parity tends to accomplish these ends. Political pressures may result in provisions and administrative actions that limit the economic benefits which could be obtained from such legislation. In fact many supporters of this type of legislation think of it not primarily as a means of stabilizing income and increasing the efficiency of production, but a means by which producers can exercise monopoly control over their production in case demand falls off. This they expect to accomplish by resorting to production controls if supplies accumulate at the set loan rates.

Within the limits that incomes can be stabilized and unnecessarily wide fluctuations in prices can be reduced by storing a part of unusually large crops or a part of normal crops in years of unusually low demand and releasing them in years of short crops or unusually high demand, price supports could improve the functioning of the price system and improve income distribution through time. There are serious political dangers in this type of economic management but similar objections on grounds of probable political manipulation for misguided economic ends can be raised against most proposals for improving the functioning of our economic system.

The experience of other countries throws additional light on the possibility of using the price system to stabilize farm income over time. Canadians have been doing this for some time through their wheat marketing schemes. New Zealand has stabilized her farmers' income from dairy products since the early 1930's. Incomplete information suggests that a number of other countries are administering programs which stabilize farm income through time by eliminating wide year to year fluctuations in prices received by farmers. The plans in use in Canada and New Zealand appear to have popular approval. The writer is of the opinion that plans of this type are increasing rather than decreasing in number in foreign countries on the basis of favorable experience with them.

One further comment on the efficiency of the price system in allocating the use of resources in agriculture. Mr. Schultz' earlier paper effectively points out the tremendous waste of resources which developed under the free market price system of earlier

decades. It seems clear that attempts to use the price system to stabilize income through time may lead to some inefficiency in use of resources as a result of political pressures. But higher cotton prices may help many families in the cotton belt get enough money to migrate as well as encourage them to grow more cotton. In the years ahead institutional barriers will continue to be responsible for the greatest share of the misuse of resources; inefficiencies growing out of price stabilization measures will be minor in comparison.

IRANIAN AGRICULTURE—PRESENT AND PROSPECTIVE

A. G. Black

TOYNBEE speaks of the migration that took place when the climate of the Mediterranean area and of Southwest Asia became dry after the retreat of the last glaciation and how certain peoples were able to adjust to the changed environment by developing a nomadic economy. He likens this dry area to a sea, and the nomadic tribes living on the "shores" to the sea-faring peoples of other lands. Since the time of the great migration of perhaps 30,000 years ago, the nomads who resisted the forces of nature and remained have worked out an economy that permits them a meagre existence through utilizing the sparse resources of the great "dry sea" that extends from Northern Africa to Central Asia. During the course of history "islands" have been discovered in this vast area—or have been "built," and the spots made fruitful by exploiting water resources have permitted the settling of some of the nomads.

Today in S. W. Asia in Iran (and other places in the Middle East) is found an economy that still contains elements of the nomadic economy, perhaps dating from glacial times, interspersed with settled agriculture based upon use of water resources made available artificially by irrigation.

The country itself is in general arid or semi-arid and of forbidding topography. The entire central part of Iran is a high plateau with an average altitude of about 4000 feet. It is dry, the precipitation varying from almost nothing in the east-central part to perhaps 12 or 15 inches in the regions around the borders of the plateau. The central plateau is bordered on the west, southwest, and north by lofty mountain ranges. Much snow collects on these mountains and this supplies water for most of the irrigation. In the high mountain valleys it furnishes sufficient moisture to mature crops of dry land grain, and elsewhere it permits the growth of sufficient vegetation for grazing.

In the southwest is the low-lying alluvial plain of Kouzistan. In the north in a narrow belt of land along the Caspian Sea is a humid, naturally watered and relatively undeveloped sub-tropical, agricultural area of considerable promise. The rainfall is heavy—

50 or 60 inches per year—and fairly well distributed. Temperatures are moderate. Citrus is produced successfully as are crops such as tobacco, tea, silk, rice, and cotton. Much of this land remains to be cleared of an almost jungle-like vegetation. Drainage is necessary and malaria control measures must be adopted. This area, although not extensive, if properly developed, could become an important surplus food producing region.

In the northwest the country although fairly high, and in places mountainous, has enough natural precipitation to produce large crops of dry land grains. There are considerable areas under irrigation.

The climate of Iran with certain exceptions is fairly mild. Summers are hot and dry, winters moderately cold except in the mountains at high altitudes where temperatures in summer are cool and in winter severe. In southwest Iran temperatures are extremely hot in summer reaching 125 degrees or more in the shade. The winters are mild. Rainfall is light except in winter but humidity is high. Summer temperatures are so high that it is essential that grain crops mature by April.

Agricultural Organization and *Land Ownership*

In Iran small acreages of irrigated land have been reclaimed from the desert, tribesmen have settled, Villages have arisen, and the agricultural organization of the nation has taken form. In part of the country the tribes have settled only partially or not at all, and round about the settled villages prevails a type of nomadic economy that is probably not unlike that developed following the great migration that Toynbee identifies.

Of course the tribes presently in Iran have not always been in that country. Many of them apparently came to Iran either as a part of or coincidentally with the Mongol invasions of the 12th and 13th centuries. They subsequently moved to the present regions, some perhaps as late as the 18th century. The Lurs and Bakhtiari came before the Mongol invasion. The Kurds who occupy the region in northwest Iran and other areas in Iraq and Turkey and whose center is about where the boundaries of these three countries meet also seem to antedate the Mongol invasion. Their movement into Iran is lost in antiquity but they probably came from regions to the northeast that also gave rise to the peoples that eventually became the modern Turks.

It must not be thought that all villages in Iran are made up of people or of descendants of people originating from the present tribes. Persia was populated long before the influx of the present tribes. And civilizations rose and fell before the present tribes arrived. The original Persians descended from tribes with an economy shaped by the environment of the region which probably was not dissimilar from that followed by today's tribes. But the original Persians came from quite different racial stocks that had abandoned their original tribal organization long before the appearance of the present tribes. Persia has been overrun by conquerors and conquerors so many times from so many different directions that few areas of the world today are populated by people of such diverse antecedents.

But regardless of origins of the people the environment and natural resources shaped a village type of economy that traces back to antiquity, and for all that is known to the contrary can well be the type of agricultural organization formed when the original nomads first settled.

Changes have come. Slavery has gone and serfdom too. Kingdom has replaced kingdom and dynasty followed dynasty. An absolute monarchy has given way to a constitutional monarchy. The old feudal aristocracy has lost its titles but has continued in power as a landed ruling class and has incorporated its lost titles into family names—a modern innovation, by the way, dating only some twenty-five or thirty years—but the village has continued almost unchanged.

In terms of numbers of people, production of agricultural products, and acreage of land, the village organization is the typical and by far the most important element in Iranian agriculture. The village is formed around a water supply sufficient to irrigate the surrounding lands. It may vary in size from a very few families to one of several hundred. The larger villages are few in number. If sufficient land is available to require the labor of several hundred people, ordinarily several small villages are found scattered through the area rather than a single large village. The advantage of having the village situated close to the land cultivated by its inhabitants is obvious. The nature of agricultural production is such that few economies result from the formation of the larger village. Certainly in few cases would the possible advantages of the larger center, such as the opportunity for specialization, more than offset the

disadvantages of having the workers live long distances from their fields.

The area of land cultivated by each family is small. The unit of measure varies from region to region but probably the *joft* is the most frequently used unit. *Joft* means a span of oxen, mules or horses, but in this connection refers to the amount of land that can be plowed and cultivated by a span of oxen. Thus it is analogous to our one- or two-mule farms of the south. It is not a fixed unit but means a larger or smaller absolute area in different sections of the country. It typically refers to an area of about $1\frac{1}{2}$ or two hectares. The amount of land cultivated by a peasant family will usually vary from one to four or five *joft*. A peasant cultivating five *joft* is considered a well-to-do man. Most of the peasant farms are between one and three *joft* in size.

All of the villages have access to the dry grazing lands surrounding the villages. Sometimes all of the sheep or goats from the village are herded together. A wealthy peasant's sheep may be sufficiently numerous to warrant his grazing them in a separate flock.

The village is owned usually by a single owner. He looks on the village as our land-owners look on a farm. It is an operating unit and is sold and bought as a unit. The villagers are not bound to the land. They can and sometimes do leave the village to go to the villages of other landowners or to the cities. Iran is a country of large landowners. Over large areas all of the villages may be owned by one man or by one family. In certain instances these holdings may amount to several score of villages and in the case of one family several hundred. It has been commonly reported that this family owns land equal in extent to that of England. However, ownership of a single village is not uncommon. These are frequently the country estates of city professional or business men. The landowner will often though not usually have a residence that he occupies a part of the time in or among his villages. He will also have a residence in one of the larger cities and more often than not will spend most of his time there. He may not actually visit his villages once a year, and occasionally owners are found who never during their lifetimes see their villages. In such cases a local bailiff is paid to supervise the villages and to collect the rents.

Rental arrangements of course vary from region to region and include numbers of local peculiarities that defy cataloging. There is, however, a pattern of rentals that seems to be general and forms a

customary basis that may be modified by local conditions. In general, the crop returns are divided into five equal parts: one part goes to the person supplying the land, one to the supplier of the water, one to the supplier of the seed, one to the owner of the tools and work stock, and one to the supplier of the labor. In practice, therefore, the landowner gets 2/5 of the crop for supplying land and water as these are almost never separated. He may get an additional 2/5 for supplying seed and equipment, although these are nearly always supplied by the peasant. The peasant always gets 1/5 for performing the labor. In case of dry land cultivation, *daim* lands, the landlord customarily receives 1/5 of the returns or so many kilos per joft. In some areas the peasant, in addition to farming his own holding, must perform some work for the landlord such as maintaining irrigation ditches, maintaining buildings and cultivating the landlord's land. He may be paid wages for these tasks or the work may be considered merely as a part of the whole village economic organization and not entitled to additional wages. In recent years more landlords have begun to pay for these extra services, primarily because there has been a tendency for peasants to leave the villages for the urban centers. In consequence, there has developed a considerable competition among landowners for the services of peasants. There is very little direct operation of lands by landowners employing peasants or laborers.

Among the nomadic tribes division of returns of course is quite different. The tribal organization includes perhaps a million people of the total population of 12 to 15 million. (There are in addition perhaps 1,000,000 settled tribesmen who maintain to a greater or lesser degree their allegiance to the tribe.) Their production is largely from flocks which are owned by individual families or groups of families. No specific division of returns is made but a per head tax (which in a way corresponds to division of return) is paid to the tribal chiefs. These taxes do not represent a "rental" in any sense of the word. The taxes are not really considered personal income of the chieftains although in practice they are used as such. However most of the chieftains take their jobs seriously and devote much of their time and income to betterment of the tribe's conditions.

The lands over which the tribal flocks migrate from winter to summer grazing are not strictly speaking owned by the tribes, nor are the lands occupied during the summer and the winter. The latter lands are probably government owned and have never been actually

ceded to the tribes although at various times understandings respecting occupancy have been reached. For all practical purposes, however, these grazing lands belong to the tribes. They are occupied by the tribes, and the tribes are for the most part strong enough to resist successfully any efforts by the government (military or otherwise) to dispossess them.

During the seasonal migrations, however, the tribes pass over lands much of which is owned by individuals not tribal members. There are numerous non-tribal villages in the path of the migrations and frequently there is trouble between the tribesmen and the villagers caused by looting of the villages. The tribal chiefs try to keep order among their followers but though discipline is fairly good, it is not absolute. Control can be exercised only within the limits of tribal custom. If a chief tries to go beyond that he will probably be deposed. And a little looting now and then is a tribal custom that is not too severely condemned (except verbally) by either the chiefs or government authorities.

The tribal chieftains and their families own many villages throughout the tribal territories and elsewhere. These are operated much as are the villages of any other landowner. The peasants are usually settled members of the tribes but their rental and other arrangements are much the same as exist between landlord and peasant everywhere.

Certain of the Moslem shrines are large landholders. The church as such has no administrative organization similar to the organization found in the various Christian churches. But specific shrines, such as the Meshed Shrine for example, own vast acreages that for the most part have been bequeathed to them. The income from rentals is used for the maintenance of the shrines. The lands, however, are managed by the government who holds the land in trust for the shrine.

By all odds the largest landowner in Iran is the Imperial Government. Unsuccessful attempts have been made to inventory the government holdings. No one knows precisely how much land is government owned, who is occupying it, what if anything is being paid for its use or how it is being used. Considerable rent is collected from villagers occupying government owned villages, but in some cases little or none is paid and in some places members of parliament publicly encourage the peasants not to pay rents owed to the government.

In total area, of course, the government lands lying in deserts too dry for even nomadic grazing and in arid mountains is the largest. There are, however, vast areas capable of range type grazing, and hundreds of irrigated cultivated villages. The government also owns large forest holdings in the north and large areas of humid undeveloped land south of the Caspian Sea. The entire province of Kouzistan in southwest Iran is government owned, but much of this land is occupied and the legal ownership is in dispute.

In addition to the public domains there is a large and undetermined area of developed agricultural land in what is known as the ceded properties. During the rule of the dictator Shah Reza Pahlevi, he became possessed of enormous land holdings. Some probably were fairly purchased, some were "purchased"by means of outrageous coercion, some were confiscated more or less legally and some were simply appropriated after the owners were killed or imprisoned. These properties included urban and commercial properties as well as agricultural, but our concern here is with the agricultural land.

When the Shah was deposed in 1941 he ceded by a blanket instrument all of this property to the government. These lands came under the management of the government. Almost all of them immediately became the subject of litigation as it was the announced intention of the government to return to the former owners or their families lands obtained by the former Shah either by illegal confiscation or by coercion. Many of the villages were returned almost at once, others are in process of litigation. In some cases land is claimed to which the claimant may have doubtful title, as, for example, cases where the property belonged to the government in the first place. In other cases request for the return of lands has been made that appear to have been sold legitimately and for a fair price to the ex-Shah. But in the meanwhile such land may have increased enormously in value. In cases such as these the litigation will be lengthy, but the ways of the country are such that probably most of the lands claimed eventually will be returned. In the meanwhile they are managed by government agents. Rents are segregated so that eventually all income from the properties may be accounted for.

The management of these properties is unsatisfactory. As ownership is in doubt, the properties are not given proper attention, necessary improvements are not made and in general the lands do

not produce as fully as they might if they were definitely to be under the continued operation of the government. From a standpoint of the public welfare generally, the more quickly final disposition of the lands is made the better.

In so far as productivity of lands is dependent upon competent supervision and management, observation points toward the conclusion that the privately owned lands are the best managed, governmental lands much more poorly managed, and those lands under government supervision but actually owned by the Shrines or by claimants of the ceded properties the worst managed of all.

The People and Their Living Conditions

As indicated earlier perhaps 85% of the people are peasants living in agricultural villages or as members of tribes following a nomadic existence. The people are very poor. They are for the most part illiterate. Schools have not been generally established in villages. The peasants are often in ill health. It has been estimated that 90% have malaria, doubtless true in places but an overestimate for the country as a whole. They also are subject to effects of malnutrition although their diet is probably better than that of other peoples of the Middle East. Little or no medical attention is available except in the larger cities. Dysentery of various kinds is general. Typhoid is common as is typhus. Cholera is sometimes present. No cholera has been reported for several years but the recent outbreak in Egypt may spread elsewhere.

The usual diet of the Iranian peasant is bread (usually of wheat except in times of bad crops when admixtures of barley are used), tea and sugar. This is supplemented by some vegetables and root crops in season and often some fruit. A little cheese and butter are produced. The basic fat is *ghee*, the fat secured from the fat-tailed sheep. Meat is not much used although some small quantity of mutton is available in most villages.

The clothing of the people consists principally of coarse cotton. In winter some wool clothing is worn, and of course in the colder mountain areas skin coats or capes are common. Footwear, when worn, is usually made of cotton cord. Leather shoes are almost never found among the peasantry, except possibly used footwear imported from abroad.

Houses are of sun-dried brick plastered with mud, which resemble the adobe houses of southwestern United States. They

are usually built around a court with housing for animals and for grain in a part of the building. A family will usually have only a single room or at the most two. Frequently there are no windows. The roofs are often vaulted to give strength. Lumber is at a premium and usually found only as supports for the roof. Cooking is done over tiny charcoal braziers and baking in community brick ovens. Usually no proper sanitary arrangements are provided.

Water Resources

Discovery of irrigation antedates recorded history but of course is of recent date as compared with the beginning of nomadic economy.

The great powers that centered in the Tigris-Euphrates valley during early recorded history, if not founded upon, were at least made possible by extensive irrigation of the fertile lands with water diverted from the great rivers. Probably larger land areas were under irrigation during those times than today. These great works were destroyed during successive military invasions and have never recovered from the destruction wrought by the Mongol hordes of Genghis Khan and his successors.

It is not clear why these rivers have never since been as fully utilized as in ancient times, but it is possible that the irrigation works were on their way toward abandonment for reasons other than conquest and destruction by outside conquerors. Possibly silting of the canals was a factor; possibly failure of drainage with its subsequent alkalization of the land was the cause. At any rate the irrigation works have not been rebuilt and present surveys show that even with modern technics the plan to restore irrigation on a scale comparable to the ancient may be questionable.

In the Karun valley at the head of the Persian Gulf in what is now Iran widespread irrigation was practiced with water diverted from the Karun river. At Ahwaz the base of one of the ancient dams is still in existence. At one time water from the reservoir above this dam irrigated thousands of acres of the fertile plain below. But when the dam was destroyed it was never replaced, the ancient canals went into disrepair, and today this flat alluvial plain as fertile as the Nile delta or the Tigris and Euphrates (of which it is really a part) is almost uncultivated except for small areas that can be watered by pumps or by water diverted directly from the river.

Successive Persian governments for hundreds of years have dreamed of reclaiming this region but plans have never been carried

through. Indeed the entire project, which would be comparable in magnitude to the Grand Coulee project, needs to be approached with caution. From an engineering point of view it would be possible to bring this whole region under water. Should this region be successfully developed, it would be an important source of food for a large area bordering the Persian Gulf and the Indian Ocean. Probably a considerable surplus might be available for India. As this whole region is subject to crop failure and famine from time to time, it would be an invaluable bulwark against such disasters. It would constitute an important contribution toward improving the nutrition standards of many millions, living in a part of the world where sources of surplus foodstuffs are all too scarce.

But recent engineering reports cast certain doubts that must be dispelled before the project is undertaken. The silting of the Persian Gulf may have raised the level of outlets so as to make drainage impracticable if not impossible. The Persian Gulf has receded 150 miles within recorded time. Without proper drainage, these lands once irrigated, would be ruined quickly by alkali. The salt content of the available water is extremely high.

Villages have been located wherever water could be found to irrigate land. The water was diverted from the streams, most of which in Central Persia flow from the mountains surrounding the 4000 foot high central plateau, to lose themselves in salt marshes or to sink out of sight in the interior desert.

Or *ghanats* were built and water brought to the surface to irrigate a few acres or a few hundred. Here in the midst of the desert a village would be established. The *ghanat* is typical of Iran and of much of the Middle East. It consists of a row of wells dug into the gravelly soil to depths varying with the depth of the ground water. The bottoms of the wells are connected by tunnels driven in opposite directions until they meet other tunnels similarly driven from neighboring wells. They collect seepage water and are gradually brought to the surface at the desired point. The water is then distributed over the land in ditches and laterals. The size of the area irrigated depends upon the quantity of water that is delivered from the *ghanat*. The quantity of water in turn depends upon the length of the *ghanat* and the characteristics of the soil through which it runs. Should the *ghanat* tap the subterranean waters of a river that has lost itself in the desert, a large supply may be developed. Sometimes several *ghanats* will converge at a village.

Considerable engineering skill has to be applied in establishing

ghanats. The tunnel must be of the correct slope to bring the water to the surface at the point desired. The wells dug from the surface must be of varying depths depending upon the configuration of the surface. The *ghanats* frequently run through rolling country where the surface varies in altitude; thus some may be 100 feet deep while nearby ones will be only fifty feet. The important factor is to keep the underground channel at just the right degree of slope. And all this is accomplished and has been for no one knows how long, by illiterate workers who have only the most elementary engineering instruments or none at all.

Maintenance of *ghanats* is a major operation in Iranian agriculture. As the wells and tunnels are dug in gravelly soil and as there is no lining, *ghanats* are subject to cave-ins. They must be cleaned yearly and kept in constant repair. The work is dangerous and because of the danger and of the skill required, is relatively highly paid. The total expense in Iran for maintenance of *ghanats* is unknown, but it clearly constitutes a major annual charge against the agricultural product of the nation. But it is a charge, more insistent than debt or taxes, that must be met. For without *ghanat* maintenance water fails. And when water fails the village dies.

The countryside of Iran is strewn with the bones of dead villages. Hardly ever out of sight are the caved in roofs and half crumbled mud walls marking the sites of once thriving villages. And countless thousands of such settlements must have entirely disappeared. Through neglect of *ghanats* or through misadventure of some kind the water failed. In some cases the *ghanats* have been restored and new villages have been built on nearby sites. But everywhere is the mute testimony of the dependence of the people upon water and the inevitable consequences of neglect, or shortsightedness or bad luck.

Not infrequently the *ghanats* fall into disrepair when the head of the family dies and the heirs living in the city or perhaps in Europe, demanding ever more income, cannot or will not use a sufficient part of the returns to maintain the *ghanats* or construct new ones if the old ones cannot be repaired.

In all Iran possibly more land is irrigated by *ghanats* than by diversion of water from streams. They will continue to be important even though the possibilities of irrigation from streams be fully exploited. There are numerous possibilities of increasing the irrigable land through exploiting streams. Most of such projects

are small and if developed would irrigate only a few hundred or at the most, a few thousand acres at each site. By far the most important large scale project is that of Kouzistan at the head of the Persian Gulf. Should that develop successfully it would revolutionize the whole agricultural industry of Iran and of neighboring lands but as indicated earlier, it is a project the success of which is uncertain.

Perhaps the irrigated land of the country could be doubled if better use were made of water already developed. There has been little systematic exploitation of water available in the rivers. Water has been drawn or pumped out of the streams by individual landowners. Little attention has been given to the rights of others and almost no regard has been shown for efficient use of water. In one irrigated area near Tehran it has been estimated that the total area could be doubled at least by systematizing the canals and laterals carrying water to the area. No means could be found of requiring landowners to engage in a fairly large scale cooperative project, and there seems to be so much mutual suspicion and distrust that the landowners are unwilling to give up what they now have in order to receive later a more adequate supply of water for a larger acreage.

Possibly their experience justifies such attitudes. Without doubt the Iranian people have not shown a high ability to carry through to a successful conclusion enterprises of this nature. Cooperation among the people for the achieving of a common end is rare. The people have even more reason to question the successful and equitable conclusion of any project carried out under governmental control.

Products and Productivity

The great staple products of Iran are wheat and barley, the basic foodstuff of the country. Grain is raised throughout the country but most successfully in the irrigated villages, in the mountain valleys, and in northwest Iran. Except for the northwest and west there may be local grain crop failures throughout the country. Usually there are grain surpluses in the northeast, in the northwest, and in the west. The area around Tehran produces much grain but because of the large urban population is always a deficit area. Isfahan in central Iran is about self-supporting. The south and southwest are sometimes self-supporting but often grain has to be moved into these areas. In the far east along the Indian frontier

is an area that produces a grain (primarily barley) surplus, but it is so isolated that its grain is not helpful to the rest of Iran. Surpluses available in this area are shipped into India. If rail connections to the Indian Ocean could be made, this area in east Persia could become a large grain producer. Irrigation possibilities are good. There are a number of other local areas of production but for the most part these are substantially self-sufficient. They never ship out grain, and in years of uncommonly bad harvests may have to import some. In the lands along the eastern side of the Persian Gulf there are often some surpluses that are traded or smuggled across the Persian Gulf. Often the trade is so extensive that grain has to be shipped into the area later to prevent starvation. A population center at the head of the Gulf—centering around the huge oil refineries of the Anglo-Iranian Oil Company has to be fed by importation of grain. The Anglo-Iranian Oil Company assumed responsibility during the war for supplying this population and has done so by importing grain by water, often from Irak. Recently, however, sufficient grain has been available in Iran, and, although prices have been high, the Anglo-Iranian Oil Company has used Iranian grain.

Along the Caspian Sea and to a lesser extent in places in the south and central parts of Iran a considerable quantity of rice is produced. An annual surplus of about 25,000 tons is available for export, primarily to U.S.S.R. Rice is not a staple in Iran. Except in the north where it is eaten in quantity by the peasants producing it, it is considered a luxury food. Among the well-to-do, however, it is a staple, and a meal is seldom served without a rice dish of some kind.

Other agricultural products are cotton, tea, silk, sugar, tobacco and opium. Cotton production has fluctuated widely. As much as 75,000 tons has been raised. In recent years, when subsidization has not been as heavy as formerly, production of about 15,000 to 25,000 tons has been usual. As this is not sufficient for domestic use, much cotton cloth is imported. Domestic production has been sufficient to keep local mills operating but they prefer cotton of other qualities and when permitted have imported cotton from abroad.

Tea, silk, and sugar are heavily subsidized. The two former crops are small. Silk is of little importance except locally. Tea is a staple and is the universal beverage among all classes of the popula-

tion. The local production is inadequate despite subsidization, the quality is poor and much is imported from India. Sugar production is inadequate for local uses, though it, too, is heavily subsidized. Production costs are high and productivity low.

Tobacco production in the north and northwest is fairly important and the tobacco is of good quality. Tobacco manufacture and distribution is a strict government monopoly. Little tobacco is imported but much more would be consumed if available.

Opium is produced from poppies raised in small plots in many parts of Iran. The principal centers of production are Isfahan, Meshed, and Luristan, but small fields are found almost everywhere. Although a government monopoly governs the production and disposition of opium, it is not effective. The production of opium was recently forbidden by law, but as no effective penalties were directed against production except against opium sale and possession, the law will probably have little effect. Manufacture of opium is very simple, requires almost no special equipment, and can be readily carried on by anyone raising the poppies. As its volume is small compared with its value, traffic in opium would be difficult to stamp out even if there was any serious attempt to do so. The only effective control would be one directed toward the growing of poppies.

Opium is easily produced. Labor requirements keep production down to small plots in the several villages. It is perhaps the most profitable crop that a village can raise, and as there is no alternative crop that closely approaches its value, the economic incentive to ceasing production is nil, especially as, under pressure, the government keeps raising the price it pays for opium.

Opium is rationed to those who are addicts, but as there is some stigma attached to its use, only the poorer addict registers for the ration. The financially able buy their supplies in the black market where the quality is often higher, even though the price may also be high. Probably not more than one third of the total opium produced is sold through the government monopoly.

The supplies that the monopoly gets are used first for rationing purposes and secondly for sale abroad to legitimate drug dealers. Some government-produced opium does get into illegitimate channels as is evidenced by the fact that the U. S. Narcotic Agents often find opium bearing the official Iranian stamp smuggled into this country.

Other agricultural products of some importance are fruits, nuts, dates. Dried fruits, dates and nuts (almonds and pistachios), are exported. The handling of dried fruits and dates is poor, and the resulting inferior products are not well received in foreign markets.

Quantities of good quality vegetables of all the common kinds are produced for local use. Lack of transportation and refrigeration facilities have not permitted the development of off-season production which the climate in various parts of the country would make possible.

Considerable carpet wool is exported, and a large quantity of skins including some high quality "Persian" lamb. The better grades of these come from Turkistan and Afghanistan and not Iran.

Livestock of the country consists of sheep and goats, poultry of all kinds, cattle and a few hogs. Beasts of burden are camels, oxen, donkeys, and horses. There are not many horses except in the cities. Although roads have been built between the principal cities and motor trucks operate throughout the country, probably the bulk of the hauling is still done by camels and donkeys. All the local assembling is done in this way, and in places caravans haul bulky produce such as sugar beets and grain for long distances. Meat animals are of poor quality but are well adapted to the rugged grazing conditions. The poultry includes all kinds common to the west but they are small and of poor quality. Egg production per hen is, of course, low.

Agricultural productivity in Iran is low by almost any measure: per acre, per man, per animal unit, per village. This universally low production is related to the climate, the soil, the peasantry, the methods of cultivation, the management. No one fact is clearly responsible but the combination results in a low production and a consequent low standard of consumption for the great majority of the people. Agricultural technics have changed but little during the past centuries, and today much of the produce is obtained by means that would have been familiar to the slaves of 2500 years ago. The ground is plowed by oxen dragging a crooked stick, sometimes iron-pointed, through the ground. Seed is scattered broadcast upon ground often only slightly prepared. The grain is cut with sickles and threshed upon clay threshing floors by beaters pulled in circles by oxen. The grain is separated by winnowing. Yields of 6 to 8 times the seed sown are usual even under irrigation.

Sugar beets are broadcast and not thinned or weeded. Yields are perhaps 4 or 5 tons per hectare (2.5 acres).

General Programs for Improvement

The foregoing descriptive material has dwelt intensively with Iran but with some variation arising out of differences in laws, land tenure, and custom, it is not inapplicable to the whole area from North Africa to India, including part of the Balkans, Egypt, and Southwest Asia. This is a region that because of its dryness has no extensive area devoted to crop production (except of course the Nile Delta). It is a land of large individual or governmental landowners operating through a village organization. Over much of the region a more or less well established tribal organization exists, in some places touching lightly the general agricultural organization, in others completely dominant. It is a region predominantly agricultural despite the presence here and there of large urban populations such as those of Cairo, Alexandria, Istanboul, the cities of Palestine and Lebanon, Damascus, Bagdad, and Tehran. The terrain and the climate ordain a large and permanent grazing economy with islands of intensively cultivated irrigated lands scattered throughout the regions wherever water can be found or developed. The people produce primarily for use. In part these observations do not apply to the Nile Valley, as the Nile economy is geared to cotton, an export crop. Surpluses usually take the form of rent which the landlords dispose of in the urban markets. Peasants sell their own grain surpluses but in some cases may sell to the landlord. Marketing arrangements are thus primitive and are often barter or closely allied thereto. Prices may vary among markets and are subject to wide fluctuation. Authentic supply and demand information is lacking, and originating and spreading of bazaar rumors to affect price is a daily, even hourly, pastime.

As production often only slightly exceeds the needs of the peasant producers, and as marketing systems are badly developed because of poor communication and means of transportation, low crop production often results in local famines or severe shortages. Few surpluses are carried from year to year because, first, there is little surplus to be carried over, and, secondly, store and warehousing facilities are so poor in quality and capacity that it is difficult to carry over even easily stored products such as grain. This situation has been corrected somewhat in Iran where several modern grain

elevators for government owned grain have been built. There is of course some adequate storage at ports.

Where shortages often develop, peasants (and landlords too) are likely to hoard their produce until there is some indication of the outlook for the succeeding crop. Favorable indications are early snows in the mountains and good fall and winter precipitation. Grain hoarded is often stored underground because of lack of above-ground storage and to prevent looting or seizure by the government in case the government is collecting grain, as most governments in this and earlier times have done more or less continually.

What can be done in this broad region that gives promise of improving the lot of the some 50 to 75 million people (according to the different official or semi-official estimates) who occupy this strategic area? Several courses of action suggest themselves, courses of action that should be carried forward simultaneously if any one of them is to achieve a goal commensurate with the effort and expense entailed.

Productivity in agriculture should be increased. In suggesting methods of increasing production full consideration must be given to the present condition of the people with respect to their general health, their education, the state of their skills and their capacity to adopt and use advanced methods of production. A general criticism that may be leveled at proposals for improvements that have been suggested by governments or local political elements is that they have been too ambitious.

Land Return

One suggestion that appeals to the politician and the people alike is that there should be redistribution of land. As time goes on there should be land reform to be sure, but land reform of the kind usually suggested is likely to be unsuccessful. In the first place reform of a far-reaching nature is so improbable that the motives of the politicians suggesting it are open to question. In the second place such reform in and of itself would probably improve the lot of the peasants little if at all. It might indeed result in a lower average productivity. The semi-feudal village is the social and economic agricultural institution of the Middle East. To abolish abruptly that institution would destroy or at best seriously impair the only existing social machinery whereby improvements other than land reform may be introduced to the people. Better by far to utilize

existing machinery and let land reform come along concomitantly with improvements in health, in education, in technical agriculture.

Governments, and this is particularly true in Iran, can make significant progress toward land reform without seriously disrupting the general social organization by experimenting in villages owned by the government itself. Here various patterns of land distribution could be made, and if at the same time programs of improvement in other directions were instituted, much could be learned of the possibilities of reform and more particularly what directions it should take and how best it may progress without danger of adverse results.

There is of course some danger in delaying land reforms by one pretext or another. The desire for reform should be encouraged and incentives for reform should be adopted. But until the lot of the peasantry has been improved, until they are enough advanced to be able to manage their lands independently, until adequate credit arrangements have been established, land reform might well result in the separate parcels of land soon finding their way into the ownership of old or new large landholders. The whole experience might well retard real reform for another century.

A revolutionary movement involving confiscation and division of estates without recompense to former owners certainly is not the answer. There seems to be little real force working in that direction at present. But in any area where there is a large exploited peasantry a revolutionary movement is always a potential threat.

There is a rather general feeling among ruling classes that reform will come in spite of what they can do to stop it. This feeling should be encouraged and all elements should aid toward adopting far-reaching, constructive methods so the reform when it comes will result in substantial and permanent benefits.

Large Scale Projects

Agricultural improvements on rather a grand scale are generally advocated. These usually take the form of large irrigation and improvement projects on the order of T.V.A. or of Grand Coulee and are usually linked with proposals to introduce large scale farming operations involving large tractors, combines and other impressive types of mechanized equipment. Advocates of these kind of improvements are entranced with the accomplishments of the western world, but they ignore or wave aside as irrelevant the fact that these

advances in the western world have come as evolutionary developments among a people that has behind it the cumulative experience of 200 years of industrial progress.

The Middle East can expect to attain the large scale projects in a much shorter time than has the western world, if it properly weighs and makes a part of its thinking the accumulated experience of the west. But to plunge headlong into constructing these huge projects or to attempt to impose intricate large scale mechanized agriculture upon its people is to invite almost certain failure. The plain facts are that these people do not possess personnel trained in large enough numbers or trained sufficiently intensively in technical matters to construct, operate, and maintain projects similar to the T.V.A. or large scale mechanized agricultural enterprises.

Agricultural Technic

The "state of the arts" in agriculture is so low that attention should be directed toward improvements that are less spectacular but that are within the capacities of governments to direct and finance and of the people to assimilate. These more humble improvements will become a part of the people's social and economic equipment and will give a basis for further steps that may in due time be taken.

Peasants should be instructed in the simplest steps of soil improvement, seed bed preparations, and crop care. Such a program will not be easy to get adopted as the peasantry is tradition bound and strongly resists change. Landlords who want to improve agricultural practices report resistance by villagers to innovation. In isolated cases they have introduced such improvements by outright coercion or even force; more often the landlord acknowledges defeat and abandons his efforts.

A program of the kind here suggested is one of vocational education of an elementary nature. It could take the form of training of "head men" in the villages and of setting up on as extensive a scale as possible demonstration plots in the villages, somewhat after the fashion followed in Mexico by Dr. Spencer Hatch. The cooperative interest of the landlord would be necessary, but in Iran the program could be put into effect on a large scale by extending it first to villages under state ownership.

Instead of aiming toward the introduction of motorized farm equipment on a large scale, getting widespread use of the simplest

farm tools and machinery would result in significant increases in production and would lay the basis for introducing the more complex machinery later if its use were justified. Such tools as the steel moldboard plow, the spiketooth or disc harrow, the simplest broadcast seeders or drills, horse-drawn cultivators and perhaps animal-powered mowers and grain binders would increase production and would enable peasants to save some of the crops now lost. As the binder and the mower are complicated machines, their use would have to be carefully supervised in order to have them used properly and to avoid breakage. In many villages the binder could hardly be used but in some the grain acreage is extensive enough to warrant its use. The small thresher of the type introduced by the T.V.A. would add much to the effective grain output of Iran by saving quantities of grain lost by the primitive threshing methods now in vogue and by improving the quality of grain by cleaning. It is not uncommon for grain delivered to markets to contain as much as 20% dirt, stones and trash. A foreign matter content of from 5% to 10% is normal.

Seed improvement programs have been started on a limited scale but should be expanded. Increased returns from improved seed would prove impressive.

Along with the programs of improvement in agriculture practices should be carried programs of water development and of systemization of existing irrigation systems.

Health

These should be accompanied by public health programs designed to bring about improvements in sanitation, control of malaria, and protection against those diseases that can be controlled by public health measures. Health programs should include efforts toward improving the nutrition of the people and of encouraging the production of kinds of foodstuffs to make better nutrition possible.

General

These programs combined would result in impressive increases in agricultural production. Positive measures must be taken to see that the rewards of such improvements do not go exclusively to the landowners. Peasants must participate. This can be accomplished in the thousands of villages owned or controlled by government by direct government decision although effective measures to control

the actions of individual landowners would be more difficult to obtain.

It is possible that improvements made would result in releasing people from agriculture. In any case encouragement should be given to establishment of small scale village industry. Such industry may serve to relieve the pressure of population on the land and in any case will supply many of the simple needs of the villagers for goods that they cannot buy. Even though such industry may be inefficient as measured by western standards, it would result in making available goods and services that the people would not otherwise have. The standard of living would be correspondingly improved.

Recourse must be had to the several international bodies that have been established for the detailed planning and direction of the programs, at least in their early stages and until technical personnel capable of carrying on the programs are trained.

The programs require financing. It is too early to know what lending policies will be established by the International Bank. The Bank may prefer loans to be used for specific physical improvements such as dam construction. In most of the so-called backward countries, however, construction projects of this kind are likely to be of less real significance than would general improvement programs of less spectacular kind. Provision should surely be made for general purpose loans as without doubt at the present stage of development of many countries the general improvement programs are much more likely to yield important and permanent benefits that will result in lasting improvement in standards of living of the masses.

Such improvement lays the basis for progressive advances that will in due course raise the general productivity of these countries to the point where they may participate in commerce on a scale commensurate with the size of their populations and of their potential productivity. In general backward countries do not provide good markets. Only by raising the standard of living of the people of these countries by assisting them to increase their productivity can trade relations develop to the fullest mutual advantage of all concerned.

PRODUCTION COSTS AS CRITERIA OF RESOURCE ALLOCATION AND POLICY

RONALD W. JONES[1]
Bureau of Agricultural Economics

COST of production in agriculture defies simple definition. Appearance of the farm family's labor and investment in the dual role of "costs" and "returns" gives rise to a variety of cost concepts corresponding to the differences in farmer, consumer, and public interests in agricultural production. The potential usefulness of cost-of-production as an analytical tool has been seriously impaired by the confusion and controversy stemming from failures to recognize the fundamental differences in cost concepts.

This confusion is not unique to this particular area of economic research—a confusion that stems from a persistent failure to distinguish between the production and welfare objectives of agricultural policy. These objectives relate to two quite different problems. On the production side, concern is with the allocation of resources. Here the test is allocative efficiency. Income problems, on the other hand, are related primarily to disparities among families in the amount of resources owned. Judgment of any distribution of income among people and its utilization can be made only on the basis of welfare considerations. A clear understanding of the bases and nature of the functional dichotomy separating the resource and income problems is of utmost importance.[2]

The Concept "Cost" as Applied to Policy Formation

That this necessary understanding generally is lacking is manifested by the typical misconceptions of the nature of agricultural costs and misinterpretations of production cost data. Costs, like prices, are "per unit" magnitudes. They cannot, therefore, have any direct significance to personal income distribution which depends upon the volume of output per person or per family. Never-

[1] For their helpful criticism and suggestions for improvement, the author is indebted to many colleagues in the Bureau of Agricultural Economics and to faculty members and fellow students at the University of Chicago. Particular credit is due Sherman E. Johnson and Carl P. Heisig, Bureau of Agricultural Economics, T. W. Schultz and D. Gale Johnson, University of Chicago, and Glenn L. Johnson now at the University of Kentucky.

[2] See T. W. Schultz, "Economic Effects of Agricultural Programs," *American Economic Review* (supplement), February 1941, and "Production and Welfare Objectives for American Agriculture," this JOURNAL, May 1946.

theless, production "costs" have acquired an ethical connotation of "a fair price" which can have meaning only as it implies some notion of an "adequate" or "parity" income. Thus we find most of the requests for cost estimates coming from persons and groups interested in using them as bases for price negotiations; i.e., to bolster an argument for altering the existing *income* distribution. Economists have made their contribution to these popular misconceptions, perhaps inadvertently, by presenting average costs per unit in dollar-and-cent terms. This method of presentation inevitably imputes an unrealistic objectivity to the subjectively evaluated cost estimate. Obscured is the fact that any dollar-and-cent cost projected into the future holds only for one arbitrarily assumed value of a "fair return" to the operator-family's resources. What is a "fair return" depends upon an individual's particular point of view. These normative valuations are the principal source of controversy on the "accuracy" of any particular cost estimate.

Even more important from a policy standpoint, conventional dollar-and-cent costs usually imply an erroneous set of norms. Set out as they characteristically are against a product price, they suggest only one possible line of political action—administered prices. It is almost impossible to avoid an ethical connotation in such price-cost comparisons. As economists it is our privilege and duty to set out empirical facts against our normative valuations to indicate what we think *ought* to be done to "better" conditions. We should never lose sight of the fact, however, that norms and facts are two quite different concepts. Nor that in policy formation the choice of *ends* as well as the choice of *means* are matters for political decision.[3] This does not suggest that either economic research or policy recommendations should be guided solely by political expediency; rather that the impact of the indicated policy upon the distribution of political power and upon existing institutions be appraised carefully as an important factor influencing its acceptance or rejection.

The main purpose of this paper is to re-examine certain existing ideas about the nature of costs in farming. Our belief is that important advances can be made in research in this area by a reformulation of the elements of costs. The approach outlined in this

[3] For an excellent discussion of the role of means and ends in policy formation, see D. Gale Johnson, "The Use of Econometric Models in the Study of Agricultural Policy," this JOURNAL, February 1948, pp. 117–120.

paper makes possible the use of a concept of costs that can be identified and measured in physical (resource) terms. This approach to agricultural cost research is based on marginal analysis and it is keyed, therefore, to the broader outlines of economic theory as a method for determining allocative efficiency in agriculture.

The broad outlines of the proposed method for deriving and presenting production cost estimates are set out in table 1. The details are developed in succeeding pages. But before proceeding to the method itself it is necessary to make certain that we are together on concepts and terminology. This cost field has been cultivated so thoroughly over the years that few key terms still have a uniformly accepted meaning.

The Nature of Farm Production Costs

Few economists will contest the definition: "The cost of any value is the alternative value given up in choosing it."[4] But there is far less unanimity on *a* method for distinguishing among the plurality of "alternative values." This is true because no one method will produce estimates which serve adequately all of the needs for cost data. For example, a frequently used classification distinguishes cost "types" on the basis of the expected use of the estimates: (a) historical or actual costs, (b) adequate income costs, and (c) necessary costs, i.e., those that must be realized in price if a given volume of production is to be maintained.[5] Our interest here centers upon the first type: historical costs. As this class is more inclusive than its name implies, it is here subdivided on the basis of "time" and "conditions."

From a "time" point of view, costs may be "actual" (relate to a completed production period) or "expected" (relate to a forthcoming production period). For convenience, we refer to them here as *ex post* and *ex ante* costs respectively. Costs of the latter type are significant to the individual farmer in laying his production plans, and to be sure in deciding whether or not to farm at all. It is his subjective *ex ante* marginal costs which the entrepreneur equates to his expected marginal revenue as a condition of maximizing his expected net farm returns. In a research aud policy context, these

[4] F. H. Knight, "The Ricardian Theory of Production and Distribution," *Canadian Journal of Economics and Political Science*, February-May, 1935, p. 83.

[5] M. R. Cooper, "Production Costs and Returns," U. S. Bureau of Agricultural Economics, 1939, mimeographed, p. 9.

costs are of interest to those concerned with the supply of farm products. Comparisons of costs and returns with alternative technologies under given conditions, etc., likewise fall into this category. While *ex ante* costs are essentially subjective in nature,

TABLE 1. CORN: COST OF PRODUCTION, SELECTED TYPES OF FARMS, 1940–41 AVERAGE

Item	Unit	Corn Belt farms		Wheat-corn farms, northern plains	Cotton farms Black Prairie area, Texas
		Cash grain	Hog-beef raising		
Cost per acre (excluding rent):					
Production expenses[1]	Dollars	9.63	11.01	4.56	3.73
Unpaid labor used[2]	Hours	9.9	14.8	13.7	17.4
Cost per bushel of net production:[3]					
Production expenses	Dollars	.34	.39	.28	.28
Unpaid labor	Hours	.35	.52	.85	1.30
Production per acre:					
Total yield	Bushels	47.3	38.5	21.7	20.6
Net production	Bushels	28.2	28.4	16.1	14.6
Net share rent[4]	Bushels	19.1	10.1	5.6	6.0
Supplemental data:					
Farm price per bushel	Dollars	.64	.64	.45	.54
Return to unpaid labor per hour[5]	Dollars	.85	.48	.20	.20

[1] All costs except land and unpaid labor chargeable to the corn enterprise. Farm-grown feed and seed valued at local average farm price.

[2] Direct labor plus time spent in maintaining power, equipment and buildings used in corn production.

[3] Total cost including land charge equal to cost of producing rental share; i.e., rental portion is subtracted from total production to obtain "net" production.

[4] Customary share rental less the quantity at current farm price required to cover proportionate share of building maintenance and taxes on non-cropland charged to other enterprises.

[5] Includes management return.

ex post costs are objectively determinable from empirical data on physical inputs and outputs. But more on this later.

Differences in "conditions"—that is, actions beyond the control of the farmer, farm organization, or Congress, etc., as the case may be—give rise to two important cost types: *private* costs and *social* costs. Formally defined in marginal terms: *private cost* " . . . is the increase in cost incurred by the producer as a result of increasing the quantity of factor he purchases in order to be able to produce

the increment of output . . . " while *social cost* " . . . is the sacrifice to society from having the marginal factor used up here so that it is not available for use elsewhere."[6] To the individual farmer, for example, product prices and the over-all employment situation are "given conditions." It is within the power of Congress, on the other hand, to alter either or both of these factors and to employ them as means toward achieving a greater social product. Thus social costs represent a wider range of alternative uses of resources than do the private costs that confront the individual producer at a particular point in time.

To return to the central topic and recapitulate briefly, we have arrived at a two-way classification of costs broadly describing their nature and use. "Time" considerations provide us with the concepts of (subjective) *ex ante* costs on the basis of which farmers decide how much of each commodity they should produce next year and that of (objective) *ex post* costs indicating how productively agricultural resources were used last year. These concepts are further refined by consideration of the "conditions" of action indicating at what level the decisions are to be made, that is, whether consideration is of *private* or of *social* costs. Within this conceptual framework, we can talk unambiguously about costs as they relate to resource allocation.

Throughout the rest of this paper, we shall be concerned only with *social costs*—defined in terms of the optimum use of resources —as criteria of allocative efficiency and public policy. Let me repeat that this emphasis is in no way intended to depreciate "private cost" analyses as guides to individual farmers in making the most efficient use of their resources.

The fact should be self-evident that what we have called *ex post* costs can have no meaning in terms of "sacrifice" on the part of the *individual farmer*.[7] In retrospect, each individual producer's "plan" may be assumed to have represented a short-run equilibrium position at the beginning of the production period (year). Any other

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[6] Abba P. Lerner, *The Economics of Control*, New York, The Macmillan Company, 1946, p. 75. This distinction between private and social costs based on relative market prices for factors and products is somewhat narrower than Pigou's definition which takes into account "uncompensated services and uncharged disservices," e.g., his well-known smoke-nuisance illustration. See A. C. Pigou, *Economics of Welfare*, 4th edition, London 1932, pp. 134 and 172 ff.

[7] Knight, *op. cit.*, p. 2, ff. gives an interesting treatment of this point in discussing the classical "pain cost" theory of value.

assumption would be inconsistent with the fundamental postulate of "rational behavior" which if refuted invalidates use of the economic calculus for this type of study. Therefore, each producer's production plan for any past year represents an equilibrium of marginal *private* costs and *expected* marginal revenue for each enterprise under the "conditions" as he saw them. That he did engage in farming last year is in itself proof that no other *available* employment offered a greater expected income, all things considered. All factors, therefore, were "specialized" during the past year; hence their *ex post* returns, except of cash inputs, are price-determined. What the farm-family "sacrificed" in applying its labor to (say) cotton was leisure. Rational behavior would have required transferring labor thus used to a more profitable alternative market-use had such an opportunity existed. This does not preclude "actual" wages—as the return to unpaid labor—departing drastically from "expected" wages. Nevertheless, whether the resulting net labor returns are adjudged "fair" or the family income "adequate" depends upon one's own beliefs as to the nature and quality of justice. Thus it is nonsense to refer to an *ex post* per unit "cost" estimate reflecting any given level of returns as being what it *cost the farmer* to produce a particular output.

Perhaps the fact should be re-emphasized at this point that this dichotomy of private versus social cost concepts has given rise to much of the damaging controversy discussed earlier in this paper. Methods quite appropriate for deriving "private cost" estimates from empirical data as aids to individual farmers in laying their production plans nonetheless usually produce invalid estimates of "social costs" which are the only costs that are relevant to public policy consideration.[8] The difference is one of kind—not degree. Private costs involve only the direct economic comparison of limited "means" under restrictive "conditions." In evaluating public costs, the "means" are legion and the "conditions" mainly are political rather than economic. Contract rental and interest payments and other contractual arrangements by which the money value of the product of specialized resources is divided between the owner of particular capital-goods and the farmer using them all are vital considerations in analyzing *private* costs. They likewise are central in many public policies aimed toward altering the distribu-

[8] The only exception is the special case of an optimum organization of the economic system in which private costs and social costs are identical by definition.

tion of *income*. Such contractual arrangements have no direct significance, however, to *social* costs on the *production* or resource side. All resources are owned by some member of society, or by society as a whole through its government. All institutions are capable of change by public action. Public resource policy is concerned only with the productivity per unit of resource. It is not directly material who owns a particular resource or who receives the return from its use.

Elements of the Criterion of Allocative Efficiency

Any criterion consists of two parts: observed statistical facts and an efficiency norm, a standard of comparison. Our concern here is with developing a suitable criterion of allocative efficiency. In other words, the problem at hand is to measure the relative efficiency of resources used in producing various farm commodities compared to an accepted standard.

For a *norm* we have only to turn to the conditions of an optimum organization of the economics system. Briefly stated, these conditions require equal marginal rates of substitution between any two commodities, any two factors, and so between any factor and product, and, in addition, that no improvement be possible by the abandonment of any existing form of production or the introduction of a new commodity.[9] Put another way, an optimum allocation of factors between different uses is obtained if the "marginal social benefit" from the particular increment of output of product considered equals its "marginal social cost"; that is, the sacrifice to society from having the marginal factor used up here so that it is not available for use elsewhere.[10] As individuals are considered as "producers" of labor, the marginal cost of which is leisure, these conditions preclude a constant degree of monopoly throughout the economy and also "involuntary" unemployment. As a working concept we can say that an optimum allocation requires that the marginal value of product of each homogeneous productive factor be equal in all uses throughout the economy.

Here then is the test of allocative efficiency. We have only to

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[9] For a formal statement of these conditions of an economic welfare maximum see J. R. Hicks, "The Foundations of Welfare Economics," *Economic Journal*, 1937, p. 704.

[10] Lerner, *loc. cit.*, pp. 75–76.

compare the marginal products of the resources used in producing (say) wheat with those of the respective comparable resources in alternative farm and nonfarm uses.[11] If the marginal value product of each factor is not equal in all alternative uses, a reallocation of resources would increase national production, hence economic welfare. This test indicates both the direction and the magnitude of adjustments in resource use required to achieve an economic welfare maximum.[12]

Empirical data describing the existing efficiency of resource use compose the "positive" element of our criterion, the *facts*. Sufficient data are required to determine the production function relating a particular output to the technology with which it was produced. That is, we require sufficient statistics for any given situation to determine the production function $O=f(A, B, C, D \ldots)$ in which O is the quantity of output under consideration and $A, B, C, D \ldots$ are its coefficients—labor, land, other capital, entrepreneurship, etc.

Before going further we must establish the major premise upon which the method of cost determination presented in this paper rests: typically there are *constant returns to scale* in agriculture.[13] There will be objections no doubt that in any area operators of the biggest farms make the highest incomes. But, constant returns only require that: "When all of the productive services are increased in a given proportion, the product is increased in the same proportion."[14] That is if wheat is produced with only two factors under constant returns to scale, then the product is doubled when twice the number of men are employed on twice the area of land. It is my belief that the illusion of increasing returns to scale in agriculture stems pri-

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[11] Also to be considered are the "potential" alternative uses which could be created by public action if the situation be one of less than full employment.

[12] For an application of this test in a broad policy context see T. W. Schultz, "How Efficient Is American Agriculture," This JOURNAL, August 1947.

[13] It is significant that Paul H. Douglas has based his elaborate investigations into the productivity of industrial labor on this same premise: "The final assumption which was made was that if we increased both labor and capital by a factor m, we increase the product by the same proportion. This is simply equivalent to assuming that the function $P(L, C)$ is by definition a homogeneous linear function of the first order. In order to determine whether this function would suit the requirement for a norm and to secure an equation which would describe the relationship, Professor Cobb tried and discarded various functions and finally hit upon a function of the form: $P'(L, C)=bL^kC^{1-k}$." Paul H. Douglas, *The Theory of Wages*, New York, The Macmillan Company, 1934, p. 133.

[14] George J. Stigler, *The Theory of Price*, New York, The Macmillan Company, 1946, p. 129.

marily from failure to take account of the contribution to production of the intangible resource *management.* The presumption is that managerial skill requirements increase with the size and complexity of the farm business organization. Two farms of different size as measured by (say) output, employing the same technology in terms of *physical* inputs would use management in *different* proportions. Thus the larger farm uses relatively more *total* resources than the comparison of quantitatively measurable inputs indicates.

That under conditions of constant returns to scale, the production function is linear and homogeneous greatly facilitates our task of determining farm production costs. These properties imply the familiar relationship: the sum of the marginal products of the productive services each multiplied by its respective quantity is equal to the total product. That is to say, if each factor is paid on the basis of its marginal productivity, total payment will exhaust exactly the total product. Therefore, for our particular purpose, we can consider the production function to be of the form: $O=aA+bB+cC+dD$ in which the parameters (a, b, c, and d) are the marginal physical productivities and A, B, C, and D are the corresponding quantities of inputs required in producing a particular output under *given* weather and technical conditions.[15] Our statistical problem now becomes both clearer and more difficult. Sufficient data are required to determine the marginal physical product of each of the productive services employed. The novel feature of the method of cost analysis proposed in this paper is the essentially objective determination and presentation of costs in terms of these marginal factor products.[16]

The Method: Development and Application

In discussing the development and application of the "net-production" method of cost analysis proposed in this paper, specific reference will be made to estimating *crop-commodity* production

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[15] Specifically if $O=f(A, B, C, D)$ then $O=(\partial O/\partial A)\cdot A+(\partial O/\partial B)\cdot B+(\partial O/\partial C)\cdot C+(\partial O/\partial D)\cdot D$. See R. G. D. Allen, *Mathematical Analysis for Economists,* Macmillan and Company, Ltd., London, 1947, pp. 315 ff.

[16] Should you feel uneasy about this proposition of expressing production "costs" in terms of "returns" to factors, see F. H. Knight, *loc. cit.* especially pp. 1–7. In this article Knight offers a particularly penetrating and comprehensive formulation of the fundamental concepts of production and distribution theory.

costs. This will provide an opportunity to illustrate the handling of the two important noncash cost items: land rent and unpaid labor-and-management. The method is equally applicable to livestock enterprises and for presenting average costs per unit of the composite production of a farm or group of farms.

Let us suppose that we have at our disposal all of the observable data obtainable for (say) the wheat enterprise on *each farm* which produces wheat commercially in the United States. Included are: production; acres of land, hours of labor, cash expenses; value of power, machinery, buildings, etc.; customary rental shares; and product price. This assumption deliberately side-steps the several difficult problems involved in allocating joint costs among the productive enterprises. Procedures for handling these accounting problems are well established if not standardized and their discussion is beyond the scope of this paper.[17] The primary assumption is laid in terms of the individual production unit for specificity of reference. It is important to keep in mind, however, that costs have the dimension "per unit of product" and can be aggregated to obtain the approximate average cost for any desired level of generalization. Valid comparisons may be made between individual farms, types of farms, production areas, and commodities, and between farm and nonfarm uses of the same resources. If they are to serve as bases for public policy formation, it is of utmost importance that the data be aggregable to permit representation of the whole of the (commercial) production of each respective commodity. In this discussion, therefore, "farm" is a spacial concept referring to an average for any given area of production. But remember, we are discussing *ex post* social costs and not *ex ante* private costs.

As a first approximation let us distinguish two classes of inputs: cash and noncash. This dichotomy has a sound basis in the theories of social income accounting and resource policy. In an enterprise economy, public policy can be effected only through the decisions of individual firms. The "firm," as a decision-making unit of organization, in a narrow resource sense comprises those productive factors whose returns are *determined primarily by* its decisions—the

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[17] The current efforts of the North Central Farm Management Research Committee to establish uniformly acceptable accounting procedures and rates for enterprise studies is a salutary step toward resolving the perplexing conflicts of results and destructive debates growing out of differences of opinion on accounting procedures.

operator-family and land. The operator-family labor-management complex (symbolically F) obviously belongs here as the repository of primary entrepreneurship. Land (excluding buildings, referred to as L) also is a part of the "firm" thus defined by virtue of its owner actually participating in the entrepreneurial function in the cases of owner-operation and share rental arrangements; or in any event by virtue of being a "fixed" (in space) resource.[18] We shall see shortly that the marginal productivity of land is determined directly by entrepreneurial decisions; by how many people decide to farm and by what technology they decide to employ. From the standpoint of resource policy, therefore, it is essential to separate the "rent-bearing" resources from those whose prices are "given" to the firm.

In social accounting, it is required to subtract from the *gross* output of each firm the goods and services purchased from other firms or produced in previous periods in order to get the firm's *current* contribution to the "net national product."[19] By our definition of the agricultural "firm," all of the "cash" inputs are goods and services produced by other firms in the economy or by the same firm in a previous period. Furthermore, their prices are determined primarily by factors outside of agriculture. The presumption is that farm operators know the expected marginal value product of these "other capital goods" and equate them to their respective purchase prices as a condition of maximizing expected net returns.

Whether the *ex post* product-value attributable to this composite of inputs corresponds to its *ex ante* value is a matter of indifference to the present analysis. It is important only that these resources were used up in particular farm production. At the time of purchase they had value in another use approximately equal to their competitively determined price; hence the contribution of the particular agricultural effort to the national dividend is only that production which is in excess of these resources bought for cash (or equivalent).[20] This is entirely consistent with the observed relations

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[18] This in no way implies that land as "capital" is fixed in any quantity sense. Certainly land-capital can be transferred through disinvestment. The amount of capital represented by a given physical tract, however, is determined by its present and expected production and a discount rate.

[19] For a definition of this concept of national dividend and its content see *National Income Supplement to Survey of Current Business*, U. S. Dept. of Commerce, Bureau of Foreign and Domestic Commerce, July 1947, p. 8.

[20] An alternative hypothesis would make the *ex post* value of the marginal product

between net farm income and prices paid and received by farmers.

So let us re-write our production function in physical terms as $O=aF+bL+E_o$. Then $O-E_o=O'=aF+bL$ which says that the net product of the firm equals the sum of the products of the two rent-bearing factors. Now if we can establish either a or b our system will be determined. But we rather summarily have thrown a great many different kinds of things into the "cash input" category. Its composition bears further investigation.

Production Expenses

Rechristening this group of cash and cash-equivalent expenses perhaps will help to avoid misconceptions of the nature of the items included. As the subscript indicates (E_o), these production expenses are expressed in the equation in terms of units of product at the current farm price. Included are:

Hired labor, which is separated from operator-family labor because of the distinct differences between the factors affecting the allocation of the two resources. Policies aimed toward altering the allocation of hired labor among farm and nonfarm uses cannot be effected successfully through the farm-product price mechanism. Under the postulate of rational behavior, farm wage rates, if properly measured, are presumed to reflect the marginal value productivity of hired farm labor in its present use. A direct measure thus is provided of the comparative efficiency of this factor in farm and nonfarm uses. It should be apparent, however, that hired labor wage rates cannot be assumed to bear a necessary close correspondence to the marginal value product of unpaid labor. Completely different conditions influence an entrepreneur's choice between (say) hiring more labor and buying additional machinery than between using more fully the available family labor and buying the additional machinery.

Other cash expenditures, such as fertilizer, gasoline, threshing, ginning, taxes, etc., which certainly belong here as demonstrated above.

Seed, which represents previous production and so a charge against the output of the current period. Whether or not it is grown on the farm where used, the *social* cost of the seed must be presumed to equal its comparable price in the market.

Depreciation and repair of power, equipment, and buildings likewise constitute production of a prior period, or perhaps of the current period,

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of such capital goods equal to their purchase price and take out production expenses as a distributive share. This I reject as untenable, particularly as the marginal value product of L and F necessarily varies with weather and product price.

In the special case where sufficient data are available to determine a production function, the *ex post* marginal product of cash inputs can be estimated directly. It is questionable, however, if this method is preferable to the social accounting approach suggested in the text for the present purpose of cost analysis.

by other firms in the economy. If all depreciation were replaced instantly (as in the classical "stationary state"), this group of items would appear as part of "other cash expenditures."

Interest on the nonland capital employed is the one item included which logically does not belong in this category. Admittedly, this capital is a resource of the "firm" in exactly the same sense as is land capital. Its *ex post* return likewise is a "rent" determined primarily by decisions of entrepreneurs. Unfortunately, however, research to date has not provided an objective criterion of the marginal productivity of *working* capital or of its component types.[21] Therefore, we can but choose between two unsatisfactory alternatives: (a) ignore the product of nonland capital and let it be subsumed in the labor return or (b) assume that an appropriate market interest rate multiplied by the estimated inventory value of nonland capital (or a composite of rates and values of sub-groups) is a reasonable approximation of the product of nonland capital. The latter is accepted here as the happier choice. That the item is small (usually less than 10 percent of the total product) reduces the practical error if not the theoretical error imposed by inadequacies of existing research.

Land-Cost (excluding buildings)

The determination of land-cost is the key feature distinguishing this "net-production" method from conventional "dollar-and-cent" methods of cost analysis. The basic assumption: net *share rent* closely approximates the marginal physical productivity (hence social cost) of land used for production of commercial crops.[22] This assumption is made only for the great commercial crop-producing regions of the United States in which share rental rates are well

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[21] The pioneer work of Tintner, Brownlee, Heady, and Johnson in estimating the marginal productivities of factors used in agriculture from production functions derived from input-output data strongly recommends this as a technique for filling these important gaps in the existing body of research materials. It is to be hoped that this research will be broadened to test more fully the range of possibilities of the method and to produce the generalized estimates of factor-products needed in many other research analyses. For a discussion of the technique and some of its uses in economic research see Earl O. Heady, "Production Functions from a Random Sample of Farms," this JOURNAL, August 1944, and D. Gale Johnson, *Forward Prices for Agriculture*, Univ. of Chicago Press, 1947, p. 105 ff.

[22] "Net" share-rent is used here to refer to the customary rental-share of a crop less its proportional credit for the building depreciation and rent on noncrop land, customarily covered in *gross* crop-share rent but chargeable to other enterprises. On share-rented cash-grain farms in the Corn Belt, for example, one-half of the corn customarily is given as rent. From his share of the production of corn and other crops, the landlord must pay the taxes on the entire farm, his share of current production expenses, and maintain the buildings. Under the straight crop-share rental arrangement, therefore, crop rents cover the rental value of pasture and other noncrop land and the depreciation, repair, and taxes on the dwelling and service buildings none of which are chargeable directly to crops as costs. In computing "net

established.[23] A small proportion of cropland share-rented in any area is important only as it limits the validity of generalizations from the sample to the parent population.

Earlier we derived the net-production equation $O' = aF + bL$ and concluded that these data for each "firm" can be aggregated for any desired production area. Furthermore, the accepted condition of "rational action" implies (and it was postulated explicitly) that an intra-firm *ex ante* equilibrium exists *within* agriculture at the time the production plan is made. Let us now suppose for a moment that the equation refers to the *ex ante* national agricultural production plan for a given season. The *expected* net output equals the sum of the *expected* products of all families and land (the product of other capital having been subsumed in production expenses). As land is spacially fixed, the marginal physical productivities of F and L alike are determined by the magnitude of F (for simplicity say the number of families engaged in farming). Land as a capital quantity is measured in terms of *productive capacity;* hence, in this context, by expected net product rather than acres. It has as one dimension *intensity* which depends upon the precise description of the production plan. Therefore, for any production plan and corresponding magnitude of F, "basic rent" is the product of land at the social margin.[24] As a condition of equilibrium, the marginal value product of land must equal the "price" of land use. This "price," like all other competitively determined prices, must be the same for all users of land (recalling that land as a capital form is an abstract quantity of productive capacity). Some idea of this average product is the critical element in determining land prices and contract

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share rent," these expenses are converted to a quantity at current farm prices and deducted from the corresponding quantity of gross share-rent.

For a hypothetical Corn Belt farm, the rent charge to the corn enterprise is calculated as follows:

Gross rental value of entire farm (current product prices)	$2,155
Rental value of pasture and other noncrop land	110
Depreciation and taxes on all buildings	315
Net share rent chargeable to crops	1,730
Percent of gross rental ($1,730 ÷ $2,155)	80%
Gross rental share of corn produced (1/2)	1,870 bushels
Net share rent charged to corn enterprise (80% of gross)	1,495 bushels

[23] A substitute method embodying the same principles which seems applicable to other areas and types of production will be discussed briefly later.

[24] See Douglas *loc. cit.* especially chapters 2 and 3 for an excellent discussion of the theoretical foundations of the marginal productivity doctrine and its application to empirical economic research.

rental rates. Competition is presumed to force each individual operator to so combine his resources that the marginal private product of land equals its average social product which is its marginal cost in a physical sense. Variations in contract rents or in "normal" market values reflect differences in qualities of land just as industrial wage differentials reflect allowances for productivity differences between workers with different levels of skills. Theoretically, then, the "rent" of any quantity of land bears a definite technologically determined relationship to the average productivity of land at the social margin of cultivation.

Thus far we have been concerned with land's share of *expected* production. This application of the marginal productivity principle is premised upon a situation of short-run intra-firm equilibrium in terms of *expected conditions*. It is my hypothesis that in contract share rental rates we have a facility for bridging the gap between expectations and realization. When the production plan was made, the relationship between the *expected* returns to land and family labor-and-management discussed above presumably existed. Abstracting from price uncertainty and inaccurate knowledge, *actual* production will differ from expected production only as a result of vagaries of weather. Therefore, the actual product to be divided between Family and Land (above production expenses) is a percentage of the expected amount. As the ratio of F to L is not (necessarily) altered, their respective percentage shares must be the same in both cases.

Theoretically, then, the "rent share" of the physical product of any particular tract of land in a particular use and under given weather conditions stands in a relationship defined by the production function to the ratio of land to nonland shares in distribution at the social margin. This distribution is institutionalized in contract share rental arrangements. There is nothing in land ownership nor in particular money-rent contracts as such that can affect the fundamental relationship (*ex post*) between the proportionate shares in distribution. Therefore, the competitively determined share given as rent on share rented land can be imputed as a cost to all other land of *like quality* in the same use and subject to the same weather conditions. That in practice the rental share of a crop reflects some production expenses and a part of the "firm's" return to management (including risk bearing) need not detain us at this point.

It is too much to expect that customary rental shares accurately reflect all of the differences between qualities of land or of the changes between years in the *ex post* marginal productivity of land under uncertain price and weather conditions. My only contention is: share rental approximates more closely than does any other objective criterion the marginal physical product of land used in producing a particular crop in any area where a significant percentage of the land used in producing that crop is rented on a share basis. Further, that share rent measures the social cost of such particular land use accurately enough for the approximations needed in policy considerations. It is important to note that the observation of rental shares remaining relatively unchanged over long periods is *not in itself* disproof of the stated hypothesis. This could result from any of several combinations of changes in the organization of agricultural resources. In fact, taking agriculture as a whole, the percentage of the total product going to land has remained exceedingly stable over the last 35 years.[25]

We should keep mindful of the shortcomings of contract rent shares, however, and seek ways of mitigating them. One arises from the fact that production expenses are not shared between landlords and share tenants in the same proportions as is the net product. This raises the awkward question of the extent to which the associated risks are institutionalized in the rental shares. These differences could result in considerable error of estimate in local areas of severe drought or highly fortuitous weather. Another weakness stems from the practical problem of weighting the various qualities of land properly in deriving the average rental share for an area. Previously we have proceeded as though there were a margin of productivity common to land in all uses. But this is accurate only in a very broad sense, for there are innumerable qualities of land and noncompeting uses each with a unique social margin. Therefore, the potential error in imputing the market rental share on share rented land to owner-operated land in the same use stems largely from the practical inability to know the rate appropriate to that particular quality of land. This is pretty much a technicality and merely extends the error actually introduced by the market in setting a uniform share upon all of a crop produced

[25] See Martin R. Cooper, *et al.*, *Progress of Farm Mechanization*, Miscellaneous Publication No. 630, U.S.D.A., 1947, Table 53, page 98.

in a locality under crop-share leases. Also to be reckoned with is the fact that owner-operators and tenants enter the annual competition with quite different subjective valuations of resources. All of these problems merit further research.

A word must be said in passing as to the comparative merits of the conventional criteria of land costs: (a) current cash rental rates and (b) interest on the estimated current investment value of land. As measures of the social cost of land in a particular use, these bases of dollar-and-cent estimates share a serious limitation: lack of specificity. On the one hand, neither provides an objective basis for differentiating among enterprises—certainly not among different uses of cropland. This usually leads to the erroneous presumption that each acre of land in a farm (or the cropland at least) has the same productivity regardless of its use in a particular year. That this is contradicted by facts is apparent when one compares the net returns from an acre of cotton with that of another planted to corn.[26] Again the *intensity* dimension of land use assumes paramount importance. Second, neither measure is specific with respect to the allocation of net product between the land and family factors. By virtue of their "contract" nature, both make the marginal value product of land essentially a fixed amount. That is, the "rent value" is independent of price and weather variations except as allowance for uncertainty holds *expected* land returns closer to a long-run average than the realized annual marginal product of land would justify. The net effect is that all of the error in estimating the actual marginal value product of land, plus or minus, redounds to the residual claimant—unpaid labor-and-management. As criteria of allocative efficiency and guides for resource policy considerations, the labor-management returns thus derived have doubtful validity.

Earlier discussion has stressed the fact that Land, not the Family, is the residual claimant in the sense that its marginal productivity is determined by the entrepreneur's decisions. Cash rental rates and land values both are derived from the *expected*

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[26] Or take the classic illustration of land values in the flue-cured tobacco-growing areas of North Carolina where it commonly is said that any farm is " . . . worth exactly the AAA tobacco allotment . . . the value of this allotment varies from $1,000 to $1,500 an acre." Frank H. Jeter quoted by John E. Mason, "Acreage Allotments and Land Prices," *Journal of Land and Public Utility Economics*, May 1946.

marginal product of land and tend constantly toward a closer approximation to its market value.[27] In the case of interest on estimated land values, the probable error is magnified by the long period of years covered by the "expectations." The net product of land in any given season is of minor importance in determining the investment value of a farm. Expectations of future trends in the rate of interest, of land productivity and of prices of farm products are the essential elements in land valuation. There is no reason why the current market value of land should bear a close relationship either to the expected or realized marginal product of that land *in any given year*. The only assumption by which the interest on estimated current market value and the marginal value product of land always could be equal in short-run equilibrium is that farmers' expectations are infinitely elastic. This is contradicted by the observed facts.

Again, I do not argue that cash rents, mortgage-interest payments, etc., are unimportant considerations to the individual farmer. They influence markedly the short-run distribution of personal income and so are basic to many phases of income-policy considerations. But our interest here is with resource allocation and with empirical data only as they provide a basis for anticipating the future. We want clues to *causes* of farmer's action or its lack. Therefore, we are not concerned with land values or contract rents as such but rather with the causal factors underlying them. Theory and experience alike tell us that, given enough time and freedom from restriction of mobility, both will tend to adjust to the true productivity of land.

For areas and products for which share rent data are not obtainable, I propose simply to work backward from land values and/or cash rental rates to an estimate of the "normal" division of the physical net product between Land and Family. Although such data cannot be used definitively for a particular year, in retrospect they do have analytical value. By comparing the product of the appropriate farm-mortgage interest rate times current land value with the market value of current production for a considerable period of years, one should be able to establish a pattern of relationship. What is wanted is an approximation of the percentage of the

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[27] " . . . buyers look to future incomes and rents as their criteria of values; even present incomes serve only as guides in their judgments." Ely and Wehrwein, *Land Economics*, New York, The Macmillan Company, 1940, p. 120.

physical product which is capitalized into land values. As previous discussion indicates, such a procedure involves a lot of guesstimating and pure speculation which precludes it from general use in computing costs of crop production. Work now being carried forward indicates that reasonably good results can be obtained for range, fruit, truck, and similar enterprises for which there are no alternative means of deducing annual land costs.

Family Labor and Management

By accepting the share-rent hypothesis, we are able to reduce our basic equation to the desired criterion of allocative efficiency—marginal productivity of family labor (including management). To recapitulate:

(1) $O' = aF + bL$ and now

(2) b = net (share) rent per unit of Land (L) less production expenses borne by landlords renting for share (i.e., those included in the rental rate), both expressed in terms of the physical product, so

(3) $aF = O' - bL$ hence $a = O' - bL/F$ which is the marginal physical product or average return per unit of labor and management.

For brevity, let us refer to a multiplied by its respective farm price P as "returns per hour of labor." This return from any particular farm use can be compared directly with returns per hour to *equally skilled* labor in other farm and nonfarm employment. As stated at the outset, differences between rates of returns to comparable resources in different uses indicate disequilibria in resource allocation. Whether and how to improve the allocation is the essence of the resource policy problem.

Some difficult problems are yet to be solved before this or any of the commonly used methods of cost and return analysis can provide a positive basis for prescribing resource policy. They relate primarily to determining the dimensions of F. In this paper conventional practice has been followed in referring to labor and management as if it were a single homogeneous resource which can be expressed as "hours of unpaid labor used." This implicitly assumes: (1) that family labor and management are used in fixed and unvarying proportions throughout the agricultural economy or (b) that management safely may be disregarded as a consequential factor. Neither seems particularly valid when explicitly stated. But, if the proportions of labor and management vary between sizes and types of farms, and hence between regions, commodities, etc., we

are left without an objective standard of measurement. If an hour of farm family labor, plus its attendant managerial skill, represents one quantity of productive capacity in one situation and some different quantity in another, there is no basis for saying whether returns per hour are equal. What is required is an objective "measure" of management return as a distributive share and its interrelations with scale of operation and farm family earnings. Some experiments with deriving management returns by use of the production function technique have yielded promising results. It is to be hoped that research in this long-neglected field can be expanded greatly. Another related problem which merits thoughtful consideration is that of reflecting underemployment of the family labor force in enterprise production costs.

Presenting the Results for General Use

Perhaps the chief merit of this "net-production" method of cost analysis resides in its permitting the presentation of results for general use that are essentially free from normative valuations. This is accomplished by reporting the *total* cost per unit of *net-production* in two parts: (a) Production Expenses in dollars and (b) Unpaid Labor (including management) in hours. (Section C—table 2.)

To illustrate, let us go back to our original equation: $O = aF + bL + E_o$. It will be recalled that bL/O is the "adjusted" *gross* rental share minus the production expenses included in the contract rental rate. These deductions are transferred to E_0. For the particular situation illustrated in table 2, the gross rental share ($\frac{1}{2}$) reduces to a net share of ($\frac{2}{5}$). The remaining ($\frac{3}{5}$) is divided between Production Expenses and return to the Family in the proportions determined by solving the equation. Prices of the production expense items we found to be determined by factors outside of agriculture and so Production Expenses may be retained as a variable. It is desirable to restore them to their original dollar units for presentation. Physical returns to Family and Land were found to be co-determined. That is, given the same technology and weather conditions, the *ratio* between these two quantities will remain unchanged through time. Therefore, costs per unit can be expressed in terms of production "net" of either one of these shares. As the product price is "given," calculated dollar-returns per unit to the remaining "fixed" factor likewise will not be altered by this

TABLE 2. CORN: COST OF PRODUCTION ESTIMATED BY NET-PRODUCTION METHOD, FAMILY-OPERATED CASH-GRAIN FARMS, CORN BELT, 1940–41

Item	Unit	Quantity		Cost per acre (dollars)	
		1940	1941	1940	1941
Hired labor	Hours	4.6	4.2	$0.99	$1.13
Tractor work	Hours	6.4	6.7	2.66	2.81
Horse work	Hours	7.8	5.8	.66	.70
Machinery	Hours	8.4	8.1	3.86	3.89
Auto (farm share)	Percent	48	32	.62	.45
Seed	Pounds	8	8	.62	.72
General farm	Percent	48	32	.08	.07

	Unit	1940	1941
A. *Cost per acre* (excluding rent):			
Production expense[1]	Dollars	9.49	9.77
Unpaid labor used	Hours	*10.3*	*9.3*
Direct labor	Hours	5.6	5.2
Maintenance labor[2]	Hours	4.7	4.1
B. *Production per acre:*			
Total yield	Bushels	41.9	52.7
Net share rent[3]	Bushels	*16.8*	*22.1*
Net production	Bushels	25.1	30.6
C. *Cost per bushel of net-production:*[4]			
Production expenses	Dollars	.38	.32
Unpaid labor	Hours	.41	.30
D. *Supplemental data:*			
Farm price per bushel	Dollars	.59	.69
Return to unpaid labor per hour[5]	Dollars	.51	1.23

[1] All costs except land and unpaid labor. Farm-grown feed and seed valued at local average farm price.

[2] Includes time spent in maintaining power, equipment, and buildings used in corn production.

[3] Customary share rental less the quantity at current farm price required to cover proportionate share of building maintenance and rent on noncrop land charged to other enterprises.

[4] Total cost including land charge equal to cost of producing rental share; that is, rental portion is subtracted from total production to obtain "net-production."

[5] Includes management returns.

handling. The obvious choice is to retain unpaid labor as the other variable factor. Returns per acre of land cannot be compared between commodities, areas, etc., within agriculture and certainly have no counterpart in nonfarm production. They cannot be made to serve as a single criterion of allocative efficiency. Consequently,

net production or product added is total output minus net share rent. In the present case, net production is $(\frac{3}{5})$ of total output. Therefore, Production Expense and Unpaid Labor calculated as per unit of *total* output each must be multiplied by $(\frac{5}{3})$ to reflect the cost of the third cost factor—land rent.

It is unfortunate that the name "net-production" implies that the resulting unit costs relate to only part of the production of a commodity. That this is *not* the case can be verified quite readily from the data in table 2. Nor should one conclude that costs calculated by this method are uniquely "share-renters' cost." Perhaps this fact also should be re-emphasized: acceptance of the marginal productivity theory of distribution on which this method of cost analysis is based requires acceptance of the postulated co-determinateness of the marginal value product of unpaid labor and land rent. This is explicit in the functional relationship between the two products. It is not valid, therefore, to calculate (e.g.) a series of "product prices" reflecting *variable* returns per unit to land and *constant* returns per unit to labor or vice versa, other things the same. Such a procedure would imply a different market price for the rent portion of the crop than for that part going to reward the operator-family labor.

In interpreting the derived criterion of allocative efficiency, this fact must be kept firmly in mind: and dollar-and-cent estimate of returns to unpaid labor per hour is valid *only* with respect to the particular *conditions* of the situation for which it was derived. We have determined *ex post* costs and returns. Last year a certain output was obtained with a particular technology and under existing weather conditions. What the output might have been had these conditions been different we do not know. The realized total output was distributed among the productive factors in accordance with competitively determined rates. Regardless of how small the respective physical returns, no more can be distributed than was produced. A certain market price for the product prevailed; a condition uniquely determining the *ex post* value of the marginal product of each rent-bearing factor. We conclude only: *if* these identical conditions of weather, technology, and prices obtain in the future the returns per hour of unpaid labor will be those indicated. Part of the economist's duty is to discover why a particular return is comparatively high or low and to provide an objective efficiency norm for judging whether the level is desirable or other-

wise. Policy decisions must be made with respect to *probable* future conditions and to the effects which changing the conditions might be expected to have upon factor returns. For these reasons, analyses of the variations and trends over a period of years are indispensable as guides to sound policy prescription.

Conclusions

This so-called net-production method of calculating (or presenting if you prefer) farm-production costs is essentially a convenient arrangement of empirical data into an analytical model. *Given* the conditions of weather, technology, and prices received and paid by farmers, this model will determine, *ceterus paribus:*

(a) The approximate per unit *social cost* of producing any farm product or combination of products expressed in terms of the *transferable* resources—Production Expenses and Family Labor—essentially free from normative valuations.
(b) The approximate value of production per hour of operator-family labor (including management) which may be used as a criterion of allocative efficiency within agriculture and between agriculture—in whole or in part—and other segments of the economy.
(c) The approximate product price which would result in any particular *arbitrarily* selected level of return to the operator-family labor per hour spent in producing that particular product.
(d) The approximate effect on return per hour in (a) of a change in the average prices of cash cost goods.

This necessarily stationary model *does not* provide any indication of a "necessary price" in the sense of the return required to assure a particular volume of production. Nor does it reveal the effect of a price change upon probable future production. Furthermore, while indicating the areas, and types and sizes of farms of relatively low and high labor productivity under observed conditions, this type of analysis *does not* provide the information needed for forecasting the pattern of production adjustments likely to result from particular changes in farm price relationships. All of these determinations require different equations. We have here only one of several fundamental equations of agricultural price-cost-production-income relationships basic to agricultural policy formation and administration. Neither this nor any of the conventional methods of estimating *ex post* production costs can perform these other functions. We should take care to respect and publicize the unique contribution of such unit cost estimates to economic analysis.

Far more significant than the method itself, is the re-direction which this formulation of the "cost problem" gives to agricultural policy. By the conventional approach, low returns to farm labor imply that farm prices were too low; hence suggest a remedy through *price policy*. Approached from the standpoint of allocative efficiency, low labor returns imply a *surplus* of *labor* in that particular use. If it has not made clear that no amount of income subsidy alone can correct the basic mal-allocation of resources rendering such subsidy payments "morally necessary," this paper has failed in one of its important purposes.

CHARACTERISTICS OF THE MARGINAL COST CURVE

W. E. PAULSON
Agricultural and Mechanical College of Texas

MARGINAL cost and marginal revenue curves are star performers in the diagrammatic demonstrations of present day economists. The marginal cost curve has been in vogue a considerable number of years. The marginal revenue curve is a more recent arrival. As late as 1930, it was referred to as "the increment of aggregate demand curve."[1] The flowering of the theory of monopolistic competition assured the marginal curves a continuing position of dominating importance.

Relations of Marginal Curves

The significance assigned to the marginal curves has pragmatic implications. Their roles may be demonstrated through the instrumentality of logic. Thus goes the argument: With a negatively sloping average cost curve, each added unit of output is produced at a cost less than the average of the preceding units; otherwise average cost would not be decreasing; in this phase of average costs, the marginal curve is below the average curve. On the other hand, with a positively sloping average cost curve, the cost of each added unit of output is greater than the average of the preceding units; otherwise the average cost would not be increasing; in this phase of average costs, the marginal curve is above the average curve.

With a horizontal average revenue curve, total income increases proportionally with increasing output. Net income, however, depends upon the behavior of costs. Granted that the ordinates of the average revenue curve be greater than those of the average cost curve: In the negative phase of average costs, total net income increases by virtue of increasing output and increasing net income. In the positive phase of average costs, total net income increases up to the output at which the marginal cost curve intercepts the average revenue curve; beyond that output, total net income decreases as cost for each added unit of output is greater than revenue.

Economists, as a rule, are not satisfied with logic alone. They illustrate the relations between the marginal curves with geometric

[1] Harrod, *Econ Jour.*, 40:238.

figures. For better or worse, these figures, in most instances, are in miniature with average cost and revenue curves, rather commonly, originating at 0-output. With a positively sloping average cost curve originating at 0-output, one wonders how the requirement of equilibrium under a competitive situation can be fulfilled—the requirement being that the average cost curve is tangent from above to the horizontal, or negatively sloping, average revenue curve.

A complete demonstration may be made of two average curves and their marginal curves as to the abscissa yielding the greatest

TABLE 1. TOTAL AND MARGINAL COSTS OF PRODUCING MILK IN LOS ANGELES AREA

Output by number of intervals[1]	Total cost	Marginal cost
13	$175.14	
14	182.05	$ 6.91
15	190.45	8.40
16	200.63	10.18
17	213.02	12.39
18	228.29	15.27
19	247.44	19.15
20	272.44	25.00
21	307.65	35.21

[1] Interval, 500 pounds.

difference between the areas of the two average curves without the slightest reference being made to average cost and average revenue of economics. Some of the present day writers of economic texts are, in large measure, geometricians. The assumption seems to be that any sort of fanciful geometric demonstration reflects precisely and accurately the realities of economics. Can it be possible that a mastery of geometry yields a mastery of economic theory?

Definition of Marginal Cost

A somewhat informal definition of marginal cost is that of Boulding: "We should always think of marginal cost as something added to the total cost by the addition of a unit of output. If we say that the marginal cost of milk, for instance, is 50 cents per gallon, we should think of a gallon being added to the output of milk and of

50 cents being added in consequence to the farmer's total cost."[2] This description seems to indicate that marginal cost represents the *perpendicular rise* in the total cost curve as output is increased from x units to $x+1$ units. It seems logical to conclude that marginal cost thus defined represents a one-dimensional, linear, concept.

A book recently off the press, *Farm Management*, by Black, Clawson, Sayre, and Wilcox, gives data on the cost of producing milk in the Los Angeles area (Table 43, p. 399). All items of cost, as recorded in the table, were reduced to cost equations.[3] With these equations total costs for intervals of 500 pounds were calculated as recorded in Table 1. From these total costs, marginal costs were derived. Figure 1 shows the total cost curve of from 13 500-pound

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[2] Boulding, *Economic Analysis*, p. 420.

[3] Estimated costs of milk production in Los Angeles area. Based on Table 43, p. 399, "Farm Management" by Black, Clawson, Sayre, & Wilcox.

I. LINEAR COSTS

Labor	= \$19.97 + \$0.2104	(Cwts. of Milk Output)
Hauling	= 0.1200	(Cwts. of Milk Output)
Cow Replacement	= 0.2638	(Cwts. of Milk Output)
Investment	= 26.50	
Total Costs Other than Feed	= \$46.47 + \$0.5942	(Cwts. of Milk Output)

II. CURVILINEAR COSTS

Productive feed costs involve two curvilinear equations: the one for estimating the pounds of TDN (Total Digestive Nutrients) required for various rates of milk output; and the other for estimating the cost of feed per pound of TDN. These equations apply specifically to the range 65–105 cwts. of milk output annually per cow.

$$\text{Lbs. of TDN} = 1.069580\left(\frac{\text{Lbs-Milk-Out.}}{1000}\right) - 0.209524\left(\frac{\text{Lbs. Milk-Out.}}{1000}\right)^2 + 0.015333\left(\frac{\text{Lbs. Milk-Out.}}{1000}\right)^3.$$

The pounds of TDN determined from the above equation multiplied by 1000 give the total pounds of productive TDN required for the specific pounds of milk output.

$$\text{Cost per Lb. TDN} = 0.009820\left(\frac{\text{Lbs. TDN}}{1000}\right) - 0.001869\left(\frac{\text{Lbs. TDN}}{1000}\right)^2 + 0.000153\left(\frac{\text{Lbs. TDN}}{1000}\right)^3$$

III. TOTAL FEED COST, PRODUCTIVE AND FIXED

Total Feed Cost = \$56.32[a] + (Cost Per Lb. TDN) (Pounds of Productive TDN).

[a] Cost of \$56.32: fixed feed cost based on a maintenance of 2920 lbs TDN at the average cost of TDN for range of output 65–105 cwts of 0.019288 cents per lb.

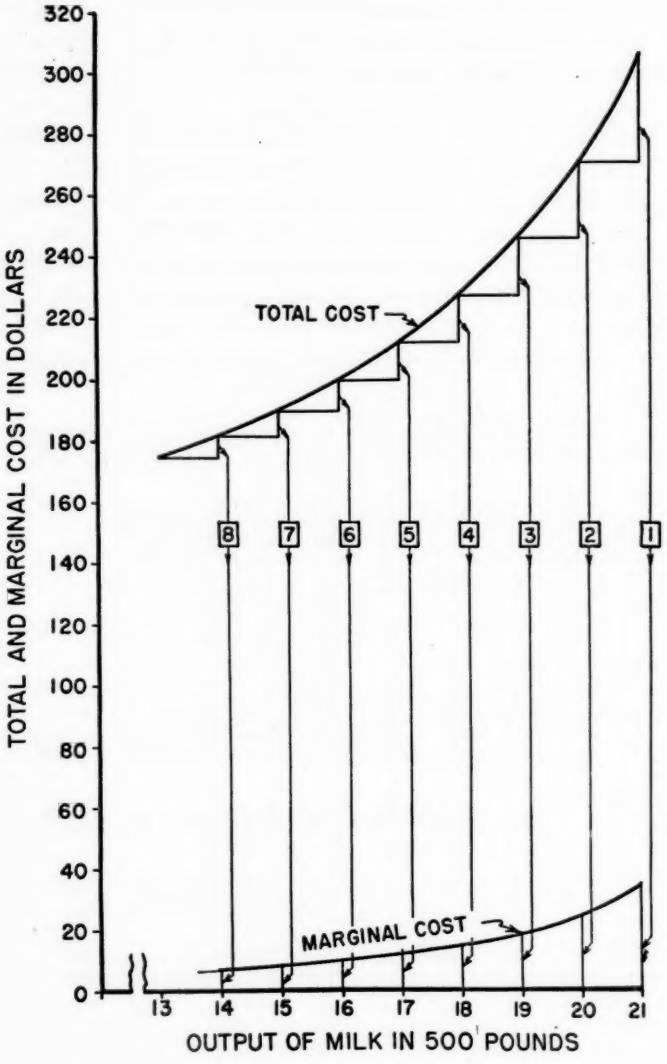

FIG. 1.—Derivation of the marginal cost curve from the total cost curve. Increase in total cost: from the 20th interval to the 21st is dropped to the x-axis at the 21st interval; from the 19th interval to the 20th to the x-axis at the 20th interval; and so on. With the total cost of 13 intervals and the successive marginal costs known, the total cost curve may be derived. The marginal cost at the 14th interval is elevated so as to represent a perpendicular rise at the 14th interval over total costs of 13 intervals; the marginal cost at the 15th interval is elevated so as to represent a perpendicular rise at the 15th interval over total costs of 14 intervals; and so on.

intervals to 21 500-pound intervals. As may be noted, the vertical increase in cost of $35.21, in passing from the 20th to the 21st interval, is dropped to the x-axis at the 21st interval; the rise in cost from the 19th to the 20th is dropped to the x-axis at the 20th interval; and so on. This illustrates the manner in which the marginal curve is derived from the total curve. Conversely, with the total cost of 13 intervals of output and the successive marginal costs known, the total cost curve may be derived by adding the marginal costs successively to the total cost of the 13 intervals. It seems that the marginal cost curve is definitely located independently of any peculiar relations it may have with the average cost curve. It may be observed that the total cost curve is cumulative; the marginal curve is additive.

Economists in illustrating marginal cost, with assumed data, very frequently manipulate total costs in such manner that marginal costs follow the pattern of descending and ascending steps of a stairway as, 20, 19, 18, . . . 11, 10, 11, . . . 18, 19, and 20 for intervals 1, 2, 3, . . . 10, 11, 12, . . . 19, 20, and 21. In such demonstrations, the concept of marginal cost adhered to is that described above.

Mathematically, it may be demonstrated that the area under the marginal curve to a given x number of intervals is equal to the total of x number of intervals. Attempts to translate this relationship to the marginal cost and the total cost curves run into several difficulties. Almost universally the cost of small output, to say nothing of the infinitesimal first unit, is outside the data. When yields fall below a certain minimum, the crop is not harvested. When the rate of milk production falls below a certain minimum, the cow is usually sent to the block. Cotton gins of Texas as a rule remain idle for the season rather than operate with a volume very much below 300 to 400 bales. Thus the data are missing for carrying the total and marginal cost curves to 0-output. The presence of fixed cost complicates the problem of carrying the marginal curve to 0-output. Furthermore, the area concept of the marginal curve is dependent upon a continuous series. The output, cost, and income of economic activity are universally discontinuous.

Stigler[4] makes a brave attempt to demonstrate the feasibility of considering economic quantities as continuous. But the example of the price of butter dropping from 35 to 34.99 cents a pound with

[4] Stigler, "*The Theory of Price*," p. 42.

demand increasing from 30 to 30.01 pounds merely calls attention to units 1/100 as large as those in common use. (Accuracy demands that the figures should be stated as 35.00 to 34.99 and 30.00 to 30.01.) These units with their appearance of minuteness are still discontinuous.

On occasions economists simulate realism in changing the number of intervals from 1, 2, 3, . . . 18, 19, and 20 to 1000, 2000, 3000, . . . 18,000, 19,000 and 20,000. Then instead of computing costs per 1000, they very frequently use a smaller interval such as 100. Thus the marginal cost per 1000 does not fit. It is then cut to measure by being divided by 10. Consequently a second definition is given to marginal cost. This concept may be expressed as an equation thus:

$$\frac{\text{Total Cost of } x+y \text{ Units} - \text{Total Cost of } x \text{ Units}}{y} = \text{Marginal Cost.}$$

Accepted Behavior of Marginal Cost Curve

One of the most widely accepted principles of economics is that the marginal cost curve intercepts the average cost curve at its minimum point. This means that the marginal cost of the least cost interval is equal to least cost. Two types of proof are offered for this relationship: one geometric and the other an exercise in logic in terms of simplifying assumptions. Boulding in Figure 45, p. 424, gives a geometric demonstration in terms of a total cost curve; and a logical demonstration in terms of the "average-marginal relationship" (p. 426).

A second basic principle regarding the behavior of the marginal cost curve is that the point of interception of the horizontal revenue curve, or negatively sloping marginal revenue curve, marks the output of greatest profit, or least loss. Thus the marginal curves assume roles as indicators of equilibrium output.

Marginal Cost as "Average" Concept

One of the cardinal offenses of economists in their use of the marginal curve is that of reducing marginal cost to an average. Such procedure is made necessary whenever average cost is derived for intervals smaller than those of the given data. For instance, total costs as recorded in Table 43 in *Farm Management* of Black *et al.*, are by intervals of 500 pounds. Output, however, is incorrectly shown as 6500, 7000, 7500, etc. pounds. With an interval of 500

pounds, 6500 pounds become interval number 13; 7000 pounds, interval number 14; etc. But in Table 44, average costs are given per 100 pounds output even though output is again shown as 6500, 7000, etc. pounds. Marginal costs derived from total costs in Table 43 do not fit average costs of Table 44. As a way out, marginal costs are divided by 5 to cut them to the pattern of the 100-pound interval.

The fallacy of "average" marginal costs may be demonstrated graphically. Figure 2 shows the curvilinear total cost curve of producing milk by 100-pound intervals for the number of intervals from 100 to 105. The "steps" in marginal costs are shown increasing from $6.02 per 100 pounds at 101 units of output to $8.25 per 100 pounds at 105 units of output. These five marginal costs total $35.21. Thus the "average" per 100 pounds is $7.04. These "average" marginal costs may be shown as "steps" in the diagram only by changing the total cost curve to a linear curve as indicated in Figure 2. Thus, in each instance, the span of costs included in the "average" marginal costs is reduced to a linear total cost curve. Such procedure on the part of economists with their well-developed bias for curvilinearity appears strikingly odd.

There is a second implication arising directly from "average" marginal costs. As is shown in Figure 2, the "average" marginal cost for 101 to 105 units of output is $7.04. Thus for these units of output the "average" marginal cost curve is horizontal and linear as shown in the insert of Figure 2. But a horizontal linear marginal curve can only be derived from a linear total cost curve having constant variable costs coinciding with marginal costs.

The data in columns (1), (2), (3), and (4) of Table 2 follow the pattern of the typical table of assumed data. But the "average" marginal costs of (4) are also the average variable costs. These average variable costs multiplied by the relevant number of units of output are shown as total variable costs in (5). By adding total fixed costs, total costs are ascertained as indicated in (6). But costs in (6) in nowise agree with costs in (2). The excesses of (6) over (2) are shown in (7). If the total costs of (6) be cut to the pattern of (2) and graphed as curves extended to 0-output, negative intercepts would result as recorded in (7).

The discrepancies between (2) and (6) of Table 2 can readily be explained. From 65 units of output, and upward, the marginal costs curve is above the variable cost curve and rises at an increasing

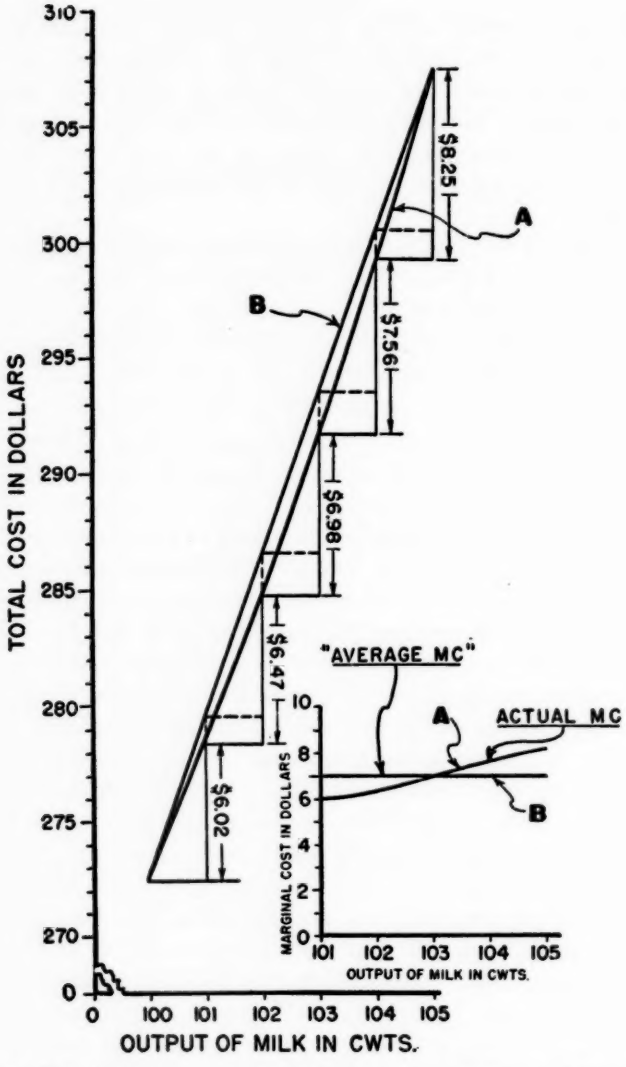

FIG. 2.—Relation between actual and "average" marginal costs. Curve A is the curvilinear increasing total cost curve of milk production for the outputs of 100 to 105 cwts. Marginal costs as "steps" increase from $6.02 at the 101st interval to $8.25 at the 105th interval. Curve B is the linear total cost curve for outputs from 100 to 105 intervals required if "average" marginal costs are to be represented as equal "steps" of $7.04. The insert pictures the relation between actual and "average" marginal costs for the range of output from 101 to 105 cwts.

rate. Thus total costs based on averages of marginal costs as the variable costs become increasingly distorted. The only way the theorists and the empiricists may avoid such an anomalous cost situation is never to resort to the use of "average" marginal costs. There is no excuse for the theorist using "average" marginal costs

TABLE 2. FALLACY OF "AVERAGE" MARGINAL COSTS

Output of milk (1)	Total cost (2)	Marginal cost (3)	Average marginal cost (4)	Total variable cost (5)	Total cost (6)	Negative intercepts (7)
6,500	$175.14					
7,000	182.05	$ 6.91	$1.382	$ 96.74	$199.53	$17.48
7,500	190.45	8.40	1.680	126.00	228.79	38.34
8,000	200.63	10.18	2.036	162.88	265.67	65.04
8,500	213.02	12.39	2.478	210.63	313.42	100.40
9,000	228.29	15.27	3.054	274.86	377.65	149.36
9,500	247.44	19.15	3.380	363.85	466.64	219.20
10,000	272.44	25.00	5.000	500.00	602.79	330.35
10,500	307.65	35.21	7.042	739.41	842.28	534.63

(1) Common manner of showing output. Outputs following 6500 pounds, however, are 6501, 6502, etc. If the intervals are by 100 pounds, then 6500 pounds becomes interval number 65; the intervals following are 66, 67, etc. If the intervals are by 500-pounds, then 6500 pounds becomes interval number 13; the intervals following are 14, 15, etc. If the intervals are by 1000 pounds, then 6000 pounds become interval number 6; the intervals following are 7, 8, etc.
(2) Actual total cost of milk production.
(3) Marginal costs by 500 pound intervals.
(4) Marginal cost of (3) divided by 5 in each instance to obtain "average" marginal cost per 100 pounds.
(5) Average variable cost of (4) multiplied by number of cwts. in (1) to give total variable cost.
(6) Total of (5) and fixed cost of $102.79.
(7) From (6), (2) is subtracted.

in that his "tailor-made" data are always conveniently under perfect control. If the empiricist would derive equations for the cost situation under analysis, he could choose such interval as best fits his particular needs.

After describing the manner of deriving "average" marginal costs as recorded in his Table 15, p. 422, Boulding makes this comment: "In the schedule we put the figure for the marginal cost between the extremes of the range over which it is calculated (in this case, 0 to 5 tons) to show that is it the marginal cost not 'at' 0 or 'at' 5 but in the range between them." This explanation for shifting the marginal cost curve is not at all convincing. Is it not

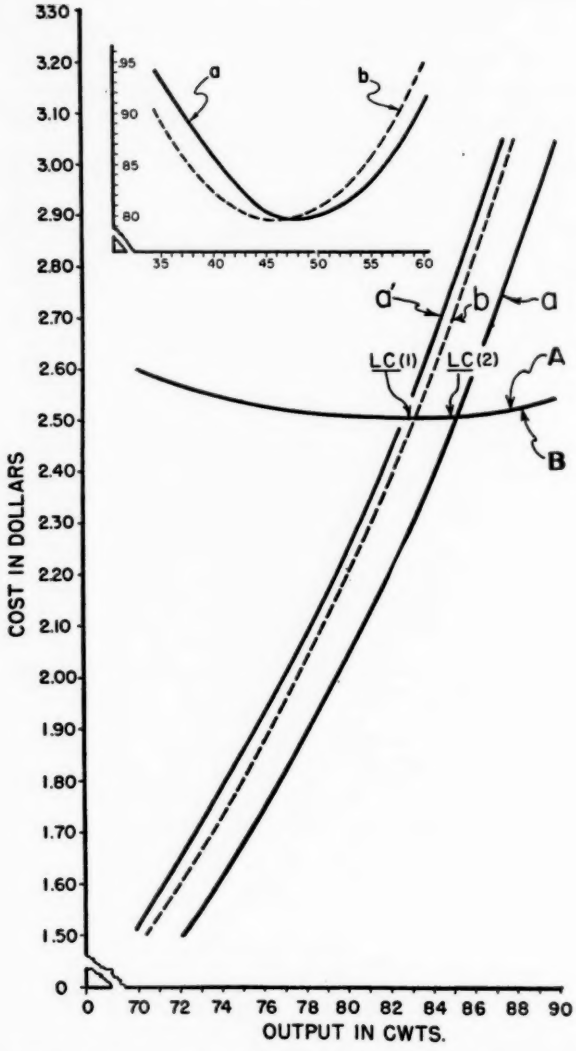

FIG. 3.—Relations among actual and "average" marginal cost curves. Curve A is average cost per 100 pounds at the successive intervals for outputs of 500 pounds; Curve B is average cost for intervals of 100-pound outputs. $LC(1)$, least average cost for output by 100-pound intervals; the number of the interval is 83 (8300 lbs.). $LC(2)$ least average cost for output by 500-pound interval computed as rate per 100 pounds; the number of the interval is 17 for the 500-pound interval and 85 for the 100-pound interval (8500 lbs). Curves "a" and "a'" are the "average" marginal cost curves in proper location and moved one-half interval to the left. For the interval of 500 pounds, the marginal cost at the least cost interval is 99.28% of least average cost (See Table 4); the "average" marginal cost per 100 pounds at interval 85 is 98.88%

because of the discrepancies between least average cost and the marginal cost of the same interval that the marginal cost curve is moved one-half interval to the left? Furthermore, it must be recognized that demonstrations with assumed data are far from satisfactory.

Figure 3 is presented to show the behavior of the "average" marginal cost curve when actual data are employed. Average cost curve A and marginal cost curves "a" and "a'" are based on Table 3. Average cost curve B and marginal cost curve "b" are based on Table 10, below. Cost curve A depicts average costs per 100 pounds for outputs by 500-pound intervals. That is, there are gaps of 400 pounds between each average cost. Curve B pictures average costs for data by 100-pound intervals. The differences in the average costs of the two curves are too slight to be shown graphically. There is a difference, however, in the least cost intervals. The least cost of curve A is governed by the 500-pound interval. In this instance, least cost occurs at the 85th interval (8500 lbs), 200 pounds to the right of the least cost of the 100-pound interval.

TABLE 3. AVERAGE AND MARGINAL COSTS AND "AVERAGE" MARGINAL COST OF PRODUCING MILK

Output by number of intervals[1]	Average cost per cwt.	Marginal cost per 500 lbs.	"Average" marginal cost
70	$2.60	$ 6.91	$1.38
75	2.54	8.40	1.68
80	2.508	10.18	2.04
85	2.506	12.39	2.48
90	2.54	15.27	3.05

[1] Interval, 100 pounds.

The significant difference between the two methods of computing average costs as represented in curves A and B comes to light in the marginal curves. Curve "b" is based on differences in total costs by 100-pound outputs. Curve "a" pictures the results of "average" marginal cost. At interval 70, the marginal cost of "b" is

of least average cost; but curve "a'" at interval 85 is about 110% of least average cost. Curve "b," marginal costs for 100-pound intervals. The inset shows that the process of averaging moves the marginal curve to the right. The "average" marginal curve is "lifted" in its decreasing phase and "depressed" in its increasing phase.

$1.49; the "average" marginal cost of "a" is $1.38. At intervals 80 and 90, the costs of "b" and "a" are: $2.20 and $2.04, and $3.32 and $3.05. The upshot of the whole matter is that the process of averaging moves the marginal curve to the right. Thus in the increasing phase of marginal cost, the curve is depressed; and in the decreasing phase, it is lifted. This relation is shown in the inset of Figure 3.

The marginal cost curve "a'" pictures the effects of efforts to "correct" the location of the curve by moving it one-half interval to the left. It may be noted in this instance that the corrected marginal curve cuts the average curve to the left of least cost by more than 200 pounds. It seems evident that this effort at correction failed of its purpose.

Garver and Hansen[5] in Table 10, p. 64, show assumed decreasing and increasing costs per unit of output. At an input of 50 units of variable agents a minimum cost of $1.10 per unit is attained. Assuming this firm be in equilibrium under conditions of pure competition, the price received per unit would also be $1.10. The marginal cost, derived according to directions in Footnote 1, p. 68, for the output of 50 units of variable input is but $0.96. This reflects how the "average" marginal curve is depressed in its positive phase. Figure 2, p. 69, illustrates geometrically the same general principles as are demonstrated arithmetically in Tables 10 and 11. But the figure is plotted for data other than those of the tables.

Dr. Geoffrey S. Shepherd[6] in Table 16, p. 147, gives a schedule of assumed costs of butterfat production. Figure 45, p. 146, shows the curves of total cost per pound and fixed cost per pound. The question is raised, How can the farmer determine the most profitable output with butterfat selling at 22¢ a pound? "The exact point at which he would stop can be determined by making separate calculations of this sort for each quantity. But the point can be determined more neatly and quickly by use of the concept of marginal rather than the average cost" (p. 148). Strangely, the marginal costs of the assumed data in Table 16 are not determined. The "average" marginal cost per pound jumps from 10¢ at an output of 10,000 pounds to 21¢ and 23¢ for outputs of 11,000 and 12,000 pounds. Thus the marginal cost curve intercepts the sales curve at a volume of 11,500 pounds. But an output of 11,500 pounds

[5] Garver and Hansen, *Principles of Economics.*
[6] Shepherd, *Agricultural Price Analysis, 2nd Ed.*

is less profitable than one of 12,000 pounds. Evidently, the marginal cost curve failed to perform its mission according to billing. In demonstrating the behavior of the marginal cost curve, Table 17, p. 149, is presented with assumed data totally different from those in Table 16.

Bowman and Bach[7] in Tables 10-1A, p. 153, and 10-1B, p. 154, present assumed costs for firms operating at a profit and at a loss under conditions of pure competition. These data are plotted. "This has been done in Figures 10-1A and 10-1B. Figure 10-1A is based on Table 10-1A and Figure 10-1B on Table 10-1B" (p. 159). Tables 10-3A p. 161, and 10-3B, p. 162, contain assumed costs for firms operating at a profit and at a loss under conditions of monopolistic selling. Again a graphic demonstration is given. "Figure 10-2A is based on Table 10-3A, and Figure 10-2B is based on Table 10-3B" (p. 164). Later in the discussion the concepts of marginal cost and marginal revenue are introduced. A geometrical demonstration is given in Figures 13-2A and 13-2B for firms operating at a profit and at a loss under conditions of pure competition. "These figures are analogous to Figures 10-1, 10-2, and 10-3; and for an explanation of them the reader may turn back to that analysis. The only additional feature, albeit an important one, is the addition of the marginal unit cost curve *which makes it possible to determine graphically what will be the most profitable (or the least unprofitable) output.* The intersection of this curve with the average revenue-marginal unit revenue line indicates the most profitable output level" (p. 203). A geometrical demonstration is given in Figures 13-3A and 13-3B for firms operating at a profit and at a loss under conditions of monopolistic selling. "These figures are analogous to Figures 10-4 and 10-5. Here two new curves are added, marginal unit revenues and marginal unit costs; the most profitable output is found graphically by determining the point of intersection of these curves and then reading from the graph the output at which this intersection appears." (pp. 203–4).

Since the only difference in the latter four figures from the former four figures, is that the two marginal curves have been added one would reasonably expect the same data to be plotted in the two instances. But the latter four diagrams are plotted for data quite foreign to those of the former four diagrams. New data were

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[7] Bowman and Bach, *Economic Analysis and Public Policy.*

introduced, apparently, because of the unruly behavior of the marginal curves plotted according to the assumed data of the tables. In Table 10-1A, the output of greatest profit has an "average" marginal cost of $1.67; the marginal revenue of the same output is $1.80. In Table 10-1B, the output of least loss has an "average" marginal cost of 33¢; the marginal revenue of the same output is 45¢. In Table 13-3, the output of greatest profit has an "average" marginal cost of 33¢; the "average" marginal revenue of the same output is 47¢. In Table 10-3B, the output of least loss has an "average" marginal cost of 24¢; the "average" marginal revenue of the same output is 40¢. These discrepancies among "average" marginal cost and "average" marginal revenue for outputs of greatest profit, or least loss, explain, undoubtedly, the reason for introducing new data for the geometrical demonstrations with the marginal curves.

Marginal Cost Curve Intercepts Average Curve at Least Cost Point

One of the most securely established principles in economic graphics is that the marginal cost curve crosses the average cost curve at its least cost point. The logic of the situation is unassailable. A negatively sloping average cost curve has a negatively sloping marginal cost curve located below the average curve; a positively sloping average cost curve has a positively sloping marginal cost curve located above the average curve. Thus as the average cost curve changes from decreasing to increasing costs the marginal curve crosses the average curve. This crossing occurs at the least cost point of the average curve. Many of the economists use this logical approach in demonstrating the behavior of the marginal cost curve.

Frequently the best of logic calls for verification. A noted economist proves by clear unequivocable logic that a negatively sloping total demand curve is impossible. Producers under conditions of monopolistic competition, which assures control over output, assuredly stop short of an output entering into a negatively sloping total sales curve. Commercial potato growers of the United States because of their great number producing in widely scattered areas, and because of the influences of weather on yields, are not in position to exercise close and strict control over output from season to season. The facts of the situation are that the total receipts of potato growers from the smallest crop to the largest are pictured

by a negatively sloping total sales curve. Logic, at times, must yield to stubborn facts.

Theorists with assumed data and empiricists with actual data have had common experience. The marginal cost curve, invariably, crosses the average cost curve to the right of the least cost point. This embarrassing failure of compliance with the rule has called forth several types of explanation. On the one hand, the contention is that the marginal concept is accurate only in a limiting sense; accurate relations between marginal cost and least cost occur only in case the interval be infinitesimal. Is this a satisfactory way out? To say that accuracy obtains only if the interval be infinitesimal offers nothing to fill the gap between least cost and marginal cost of the intervals in vogue in actual economic situations.

A second explanation of the failure of marginal cost to equal least average cost is offered by way of taking off the wraps of a third definition of marginal cost. Shepherd states that the marginal revenue (cost) "shows merely the tops of successive vertical bars, each one only one unit wide, showing the marginal revenue (cost) at each successive scale of production. Each figure in the scale along the bottom of the chart should be put under the center (middle) of each vertical bar. A line drawn through the center (middle) of the top of each vertical bar represents the marginal revenue (cost) curve" (p. 82). The explanation for moving the marginal curve one-half interval as suggested by Shepherd differs from that of Boulding. Shepherd turns marginal revenue (cost) into an areal concept. Since economic data are invariably discontinuous, marginal cost is linear, one-dimensional. Shepherd offers no explanation for moving the marginal curve to the left. Evidently, this represents one more effort to force the marginal cost curve to perform according to rule.

A third explanation is that of Garver and Hansen, p. 63. The reason for the failure of least cost and marginal cost of the same interval to agree is placed on the discontinuous arithmetical table. The assumption seems to be that in the continuous cost curve the true least cost could be ascertained. In such circumstance, it is further assumed that least cost and marginal cost would be equal. But the tribute offered to the accuracy of the curve is off key. From the standpoint of pin-point accuracy, the graphed curve is crude; readings on the curve are, at best, approximations. Curve readings referred to in texts are usually made from the table according to

which the curve was plotted and not from the curve itself. Furthermore, what is overlooked, in this instance, is that the cost curve must be graphed according to the data at hand. The low of the arithmetical table becomes the low of the cost curve. Thus all attempts to escape the discontinuity of the arithmetical table are foiled.

Width of Intervals

It seems that the relation between marginal cost and least average cost is viewed as deep mystery. It seems plausible that the failure of marginal cost to equal least average cost has called forth such outbursts as "An accurate determination of the input-output rate at any point requires the use of calculus."[8]

The empiricist with bona fide data at hand, which represents one of his greatest assets, should feel an urge to clear up this mystery, if possible. One test that suggests itself is to vary the width of the intervals in order to determine effects on relations between least cost and marginal cost. Intervals of from 0.1 pound to 1000 pounds were analyzed as reported in Table 4. In general, it is evident that as the intervals narrow, the discrepancy between least average cost and marginal cost lessens. Marginal cost is but 73.9 percent of least cost when the interval is 1000 pounds and 99.99 percent when the interval is 0.1 pound.

The deviations in pounds of the least cost units of output from the least cost when the interval is 0.1 pound are recorded in the table. The greater the deviation to the left, the greater the discrepancy between least average cost and marginal cost; the greater the deviation to the right, the less the discrepancy between least average cost and marginal cost. The least cost units of the 1000- and 800-pound intervals have the greatest deviation to the left; the least cost unit of the 500-pound interval has the greatest deviation to the right. The behavior in these instances suggests shifting these intervals so that in each case the low would be at 8269 pounds, even though this procedure violates the principle of arithmetic progression. Table 5 summarizes the relations between the original and the shifted intervals. Moving the intervals 269 pounds to the right changes the relation of marginal cost to least average cost from 73.9 percent to 82.3 percent for the 1000-pound

[8] Black *et al.*, *Farm Management*, Footnote, p. 199.

interval and from 76.7 percent to 85.5 percent for the 800-pound interval. As the interval is moved to the right, the marginal cost increases from $18.52 to $20.61 for the 1000-pound interval and from $15.38 to $17.12 for the 800-pound interval. This results from the fact that the total costs involved increase at an increasing rate.

TABLE 4. RELATIONS OF LEAST AVERAGE COSTS TO MARGINAL COSTS OF SAME NUMBER OF INTERVALS

Lbs. of milk in interval	Number of intervals least cost output	Deviations in lbs.[1]	Average cost	Marginal cost	Percentage M.C. of average cost
1000	8 (8000)	−269.2	$25.07	$18.52	73.87
900	9 (8100)	−169.2	22.54	17.67	78.39
800	10 (8000)	−269.2	20.06	15.38	76.67
700	12 (8400)	130.8	17.53	16.09	91.79
600	14 (8400)	130.8	15.02	14.06	93.61
500	17 (8500)	230.8	12.53	12.44	99.28
400	21 (8400)	130.8	10.02	9.75	97.31
300	28 (8400)	130.8	7.512	7.455[2]	99.24
200	41 (8200)	− 69.2	5.006	4.676	93.41
100	83 (8300)	30.8	2.5028	2.4835	99.23
90	92 (8280)	10.8	2.2525	2.2216	98.63
80	103 (8240)	− 29.2	2.0023	1.9471	97.24
70	118 (8260)	− 9.2	1.7522	1.7209	98.22
60	138 (8280)	10.8	1.5017	1.4900	99.22
50	165 (8250)	− 19.2	1.25140	1.22910	98.22
40	207 (8280)	10.8	1.00112	0.99734	99.62
30	276 (8280)	10.8	0.750837	0.749643	99.84
20	413 (8260)	− 9.2	0.500558	0.496669	99.22
10	827 (8270)	0.8	0.2502785	0.2498459	99.83
1	8,269 (8269)	− 0.2	0.025027844	0.025023982	99.985
0.1	82,692 (8269.2)		0.002502784541	0.002502615222	99.993

[1] A minus deviation means that the least cost of the number of intervals of a specific interval falls that many points short of the least cost of 0.1 pound; a positive deviation means that the least cost of the number of intervals of a specific interval falls that many pounds beyond the least cost of 0.1 pound.

[2] If data be graphed, accuracy requires that marginal cost be carried to same number of decimal places as average cost.

As the average cost curve flattens in its approach to the least cost point, the difference in average costs between the least cost unit of output and the preceding unit drops from $0.94 to $0.61 for the 1000-pound interval and from $0.52 to $0.31 for the 800-pound interval. In moving the 500-pound interval 231 pounds to the left, the relation between marginal cost and least average cost drops from 99.3 percent to 90.7 percent. In moving the interval to the

left, marginal cost drops from $12.44 to $11.34. The difference in average cost between the least cost unit of output and the preceding unit increases from $0.01 to $0.08.

The relations between least average cost and the marginal cost for the various intervals are shown in more detail in Table 6 than in Table 4. Figure 4 is based on Table 6. Several features of least average cost and marginal cost behavior are apparent in this figure. The location of least cost varies with variations in the width of

TABLE 5. EFFECT ON RELATIONS BETWEEN LEAST AVERAGE COST AND MARGINAL COST OF THE SAME INTERVAL OF MOVING INTERVALS TO THE RIGHT, AND TO THE LEFT

Output by number of intervals[1]	Average cost	Drop in average cost	Marginal cost	Percentage M.C. of least cost
7 (7000)	$26.01			
8 (8000)	25.07	$0.94	$18.52	73.87
7.269 (7269)	25.64			
8.269 (8269)	25.03	0.61	20.61	82.34
9 (7200)	$20.58			
10 (8000)	20.06	$0.52	$15.38	76.67
9.336 (7469)	20.33			
10.336 (8269)	20.02	0.31	17.12	85.51
16 (8000)	$12.54			
17 (8500)	12.53	$0.01	$12.44	99.28
15.538 (7769)	12.59			
16.538 (8269)	12.51	0.08	11.34	90.65

[1] Intervals, 1000, 800, and 500 pounds in order.

the interval. In four cases, the least cost is to the left of that of the one-pound interval and in five cases to the right. In five cases, moving the marginal curve one-half interval to the left would shift the marginal curve to the left of least cost; in no case would the marginal curve pass through the least cost point. It would seem that Figure 4 should explode completely the assumption that the marginal curve passes through the least cost point provided it be moved one-half interval to the left.

The analysis of relations between marginal cost and least average cost thus far seems to suggest that the drop in average cost has some bearing on the situation. While fixed cost has no effect on

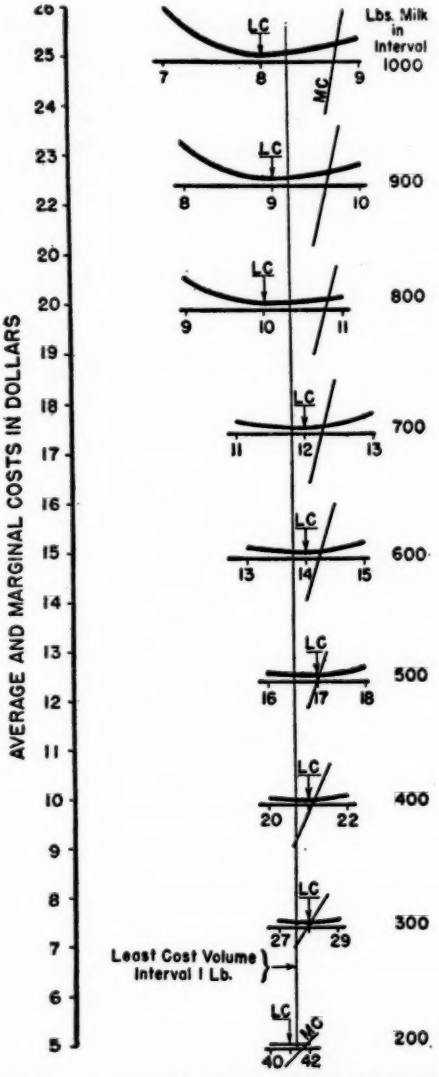


FIG. 4.—Average cost curves for various widths of interval plotted from the same x-axis. *LC*, least cost point of each curve. *MC*, marginal cost curves. Least cost falls the following number of times according to total output: 8000 lbs., 2; 8100 lbs., 1; 8200 lbs., 1; 8400 lbs., 4; and 8500 lbs, 1. Least average costs falling to the right of least cost of the 1-pound interval have their marginal cost curves much closer to least cost points than is the case with least costs falling to the left. Economists very generally shift marginal costs both in their tables and graphs (one-half interval to the left in graphs) as the means of insuring the correctness of "Marginal Cost = Average Cost, at Minimum Cost." It should be manifest in this figure that such a shift is no solution whatsoever.

marginal cost, it does profoundly affect average cost. As a test of the influence of fixed cost, Table 7 was prepared. The actual fixed cost for the year per cow is $102.79. Fixed costs were assumed, with variable cost remaining the same, $10 and $20 less than actual and $10 and $20 more than actual. As fixed cost increases from $82.79 to $122.79, the percentage that marginal cost is of least average cost drops from 82.3 to 63.4.

TABLE 6. RELATION BETWEEN POINT OF LEAST COST ON AVERAGE COST CURVE AND POINT OF CROSSING BY MARGINAL COST CURVE

Pounds milk in interval	Number of intervals	Average cost	Marginal cost	Pounds milk in intervals	Number of intervals	Average cost	Marginal cost
1000	7	$26.01	$10.78	500	16	$12.54	$10.18
	8	25.07	18.52		17	12.53	12.44
	9	25.37	27.66		18	12.68	15.27
900	8	23.15	11.08	400	20	10.03	8.33
	9	22.54	17.67		21	10.02	9.75
	10	22.83	25.39		22	10.08	11.49
800	9	20.57	10.09	300	27	7.515	6.608[1]
	10	20.06	15.38		28	7.512	7.454
	11	20.17	21.20		29	7.542	8.425
700	11	17.65	12.15	200	40	5.016	4.314
	12	17.53	16.09		41	5.006	4.677
	13	17.83	21.46		42	5.008	5.070
600	13	15.10	11.07	100	82	2.5034	2.2932
	14	15.02	14.06		83	2.5028	2.4839
	15	15.22	17.85		84	2.5040	2.5863

[1] If average costs of 300-pound interval are to be graphed accurately, the scale must be such as to carry three decimal places; to graph marginal costs to the same degree of accuracy, they in turn must be carried to three decimal places.

Actual Relation of Marginal Cost to Least Average Cost

Least average cost can obtain only if there be a drop in cost from that of the preceding unit of output to that of the least cost unit. What happens in moving from the one average cost to the other is shown in Table 8 and Figure 5. In terms of the total cost areas of the two average costs, passing from the one cost to the other involves three rectangles: the one common to both average costs, $25.07185×7; the one subtracted, $0.93588×7; and the one added, $25.07185×1. The rectangle added, or its equivalent $25.07185, is

the average cost of the least cost output. Hence according to the accepted relation of marginal cost and least average cost, this added rectangle also represents marginal cost. But Figure 5 clearly shows that the net increase in area—total cost—is the rectangle added less the rectangle subtracted. Thus the net increase in total cost is \$25.07185 − \$6.55116, or \$18.52069. As is indicated in Table 8, the

TABLE 7. INFLUENCE OF FIXED COST ON RELATION BETWEEN LEAST AVERAGE COST AND MARGINAL COST

Output by number of intervals[1]	Total cost	Average cost[2]	Drop in average cost	Marginal cost	Percentage M.C. of average cost	Fixed cost[3]
7	\$162.05	\$23.15				
8	180.63	22.58	\$0.57	\$18.58	82.3	\$82.79
7	172.05	24.58				
8	190.63	23.83	0.75	18.58	78.0	92.79
7	182.05	26.01				
8	200.63	25.08	0.93	18.58	74.1	102.79
7	192.05	27.44				
8	210.63	26.33	1.11	18.58	70.6	112.79
7	202.05	28.86				
8	220.63	27.58	1.28	18.58	63.4	122.79

[1] Interval, 1000 pounds.
[2] In each instance, 8 units least cost output.
[3] Actual fixed cost, \$102.79; other fixed costs assumed.

increase in total cost, or marginal cost, in passing from 7 to 8 units of output is also \$18.52069.

The relation between least average cost and marginal cost of the same interval may be expressed in the form of an equation: Let x = number of interval preceding least cost interval. Then,

$$\frac{\text{Total Cost}}{x} = \text{average cost of interval preceding least cost.}$$

Let $x+1$ = number of interval of Least Cost. Then,

$$\frac{\text{Total Cost}}{x+1} = \text{Least Average Cost.}$$

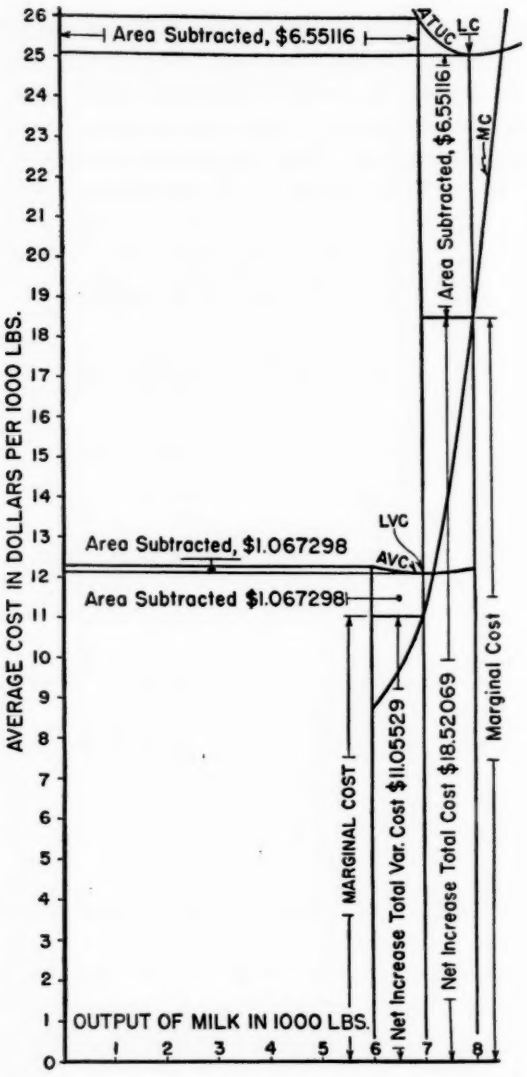

Area Subtracted, $6.55116
ATUC
LC
MC
Area Subtracted, $6.55116
Area Subtracted, $1.067298
LVC
AVC
Area Subtracted $1.067298
AVERAGE COST IN DOLLARS PER 1000 LBS.
MARGINAL COST
Net Increase Total Var. Cost $11.05529
Net Increase Total Cost $18.52069
Marginal Cost
OUTPUT OF MILK IN 1000 LBS.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

FIG. 5.—Relation between least average cost and marginal cost of the same interval. *ATUC*, average total unit cost; *AVC*, average variable cost; *MC*, marginal cost; *LC*, least cost of average curve; *LVC*, least cost of variable curve. Note the three rectangles involved in passing from the cost area of 7 units of output to the cost area of the least cost output of 8 units: the one in common; the one subtracted; and the one added. The net increase in area, or total cost, in passing from 7 to 8 units of output, which by definition is marginal cost, is rectangle added, $25.07185, —rectangle subtracted, $6.55116, or $18.52069.

TABLE 8. RELATIONS BETWEEN LEAST AVERAGE COST AND THE MARGINAL COST OF THE SAME INTERVAL

Output by number of intervals[1]	Total cost	Average cost	Marginal cost
7	$182.05408	$26.00773	
8	200.57477	25.07185	$18.52069

Difference in Average Costs: $26.00773 − $25.07185 = $0.93588.
Area of Rectangle Subtracted: $0.93588 × 7 = $6.55116.
Least Cost Area Less Area Subtracted: $25.07185 − $6.55116 = $18.52069, or Net Increase in Area, or in Total Cost.

Output by number of intervals[1]	Total variable cost	Average variable cost	Marginal cost
6	$73.80282	$12.300470	
7	84.85811	12.122587	$11.05529

Difference in Average Variable Costs: $12.300470 − $12.122587 = $0.177883.
Area of Rectangle Subtracted: $0.177883 × 6 = $1.067298.
Least Cost Area Less Area Subtracted: $12.122587 − $1.067298 = $11.055289, or Net Increase in Area, or in Total Variable Cost.

Output by number of intervals[1]	Total pounds TDN	Average pounds TDN	Additional pounds TDN
67	5292.253	78.98885	
68	5325.940	78.32265	33.687

Difference in Average Pounds TDN: 78.98885 Lbs. − 78.32265 Lbs = 0.66620 Lb.
Area of Rectangle Subtracted: 0.66620 Lb. × 67 = 44.63540 Lbs.
Least Average Area Less Area Subtracted: 78.32265 Lbs. − 44.63540 Lbs. = 33.68725 Lbs., or Net Increase in Area, or in Total TDN Lbs.

[1] Interval, 1000, 1000 and 100 pounds.

Hence,

$$\text{Marginal Cost of Least Cost Interval} = \frac{\text{Total Cost}}{x+1} - \left(\frac{\text{Total Cost}}{x} - \frac{\text{Total Cost}}{x+1}\right)x.$$

As indicated in Table 8, the net increases in variable cost (also Figure 5) and in physical units of TDN required, perform according to the equation as stated above.

It should be clearly evident that the well-established principle:

Marginal Cost = Average Cost of the Least Cost Interval,

is in error. The marginal cost of the least cost interval is always less

than the least average cost. This follows from the peculiarities of average cost. Thus the persistent behavior of the marginal cost curve in crossing the average cost curve to the right of the least cost point is explained. The discrepancy between the actual and the supposed relation of least average cost to marginal cost of the same interval illustrates vividly the perils of unverified deductions.

An erroneous belief, though generally accepted as true, through continual repetition may attain an eminence of awesome authority. Unhappily, repetition is not gifted with the alchemistic power of transmuting the dross of error into the gold of truth. In his search to fathom reality the empiricist may have occasion to draw various inferences suggested by his investigations. Strict scientific procedure demands that each such inference be thoroughly tested in terms of the data at hand. In the assaying process, he rather commonly finds that many of his deductions are base and worthless. Thus in his general attitude towards untried concepts he becomes possessed of questioning skepticism. Unverified deductions are encompassed by turbulant clouds of uneasy and disquieting doubt.

Reference has already been made to a geometric proof that "Marginal Cost=Average Cost, at Minimum Average Cost." Boulding in his Figure 45, p. 424, presents a geometric proof in terms of the total cost curve. The x-axis is scaled to tons—20, 40, 60, 80. According to the discussion of intervals and number of intervals given below, the interval in this instance is one ton. Marginal cost must, therefore, be measured in terms of differences in total costs for outputs by one ton increases. That being the case, points Q and Q′ are separated by a finite distance on an increasing cost curve. Thus OQ and OQ′ do not coincide and only one of these lines can be tangent to the total cost curve. Thus the proof offered of marginal cost being equal to average cost at the least cost point comes to naught.

Boulding gives an algebraic demonstration. Footnote 4, p. 426 in proof of the "average-marginal relationships." Constant average costs give rise to a situation marked by certain peculiarities. In this special case, several of the well-established rules of marginal cost behavior are non-operative. As a means of showing the nature of constant average costs, Table 9 was prepared. The data in this table are based on costs of producing milk by 500-pound intervals. The least cost point occurs at 17 units of output. Average costs of

18, 19, 20, and 21 units of output were moved to the right to become intervals 22, 23, 24, and 25. Average costs for intervals 18, 19, 20 and 21 were assumed as constant to agree with the least cost of 17 units. Figure 6 was constructed according to the data in Table 9. For the constant average costs of intervals 18 to 21, a peculiar situation obtains. These constant costs are maintained by average variable costs increasing by such amounts as to offset the drop in average fixed costs. The effect of this is as though average costs were completely variable. Thus two recognized principles of margin-

TABLE 9. RELATION OF MARGINAL COST TO CONSTANT AVERAGE COST

Output by number of intervals[1]	Average fixed cost	Average variable cost	Average cost	Total cost	Marginal cost
13	$7.91	$5.56	$13.47	$175.14	$ 5.79
14	7.34	5.66	13.00	182.05	6.91
15	6.85	5.85	12.70	190.45	8.40
16	6.42	6.12	12.54	200.63	10.18
17	6.05	6.48	12.53	213.02	12.39
18	5.71	6.82	12.53	225.55	12.53
19	5.41	7.12	12.53	238.08	12.53
20	5.14	7.39	12.53	250.61	12.53
21	4.89	7.64	12.53	263.14	12.53
22	4.67	8.01	12.68	278.97	15.83
23	4.47	8.55	13.02	299.47	20.50
24	4.28	9.34	13.62	326.89	27.42
25	4.11	10.58	14.65	366.26	39.37

[1] Interval, 500 pounds.

al cost behavior in this instance are non-operative, since: fixed cost does influence margial cost by complementing variable cost so that average cost becomes constant; a positively sloping variable cost curve has a horizontal marginal cost curve. These constant average costs as a total cost curve, if extended to the left, would pass through the point of origin.

In connection with the situation of equal average costs, attention may be called to Stigler's Table 12, p. 129. Variable costs are assumed to increase by constant increments while outputs are assumed to increase by increasing and then by decreasing increments. Such relations between cost and output are proper in portraying increasing and decreasing physical output. But they are

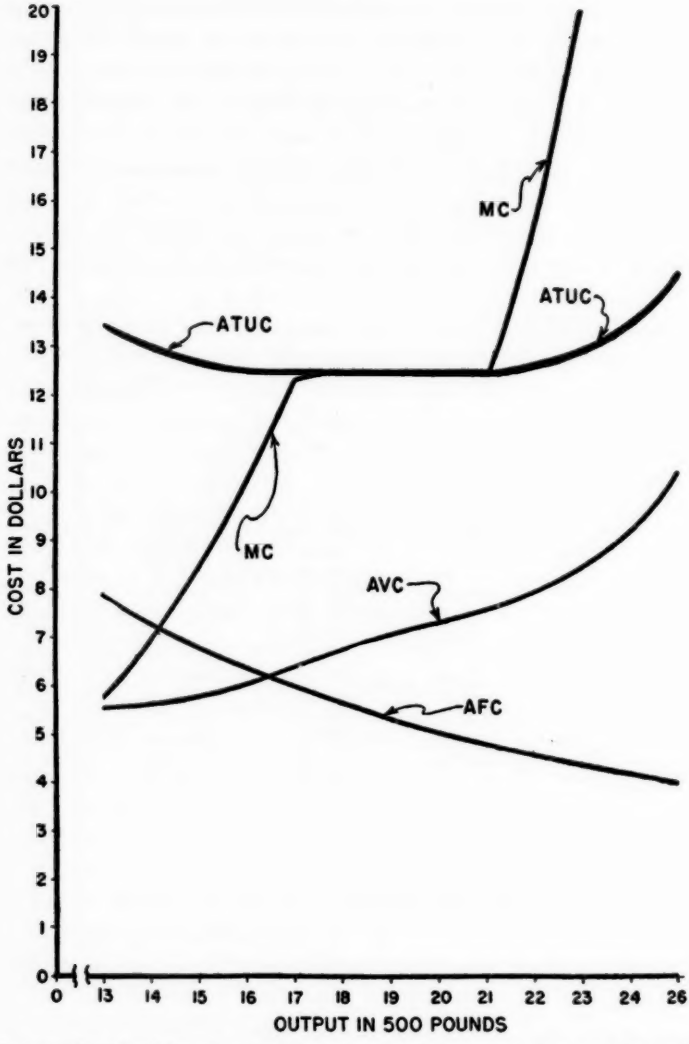


FIG. 6.—Peculiarities of constant average cost composed of fixed and variable costs. *ATUC*, average total unit cost; *AVC*, average variable cost; *AFC*, average fixed cost; *MC*, marginal cost. In the span of constant average cost: the average variable cost curve is concave to the x-axis; fixed cost affects marginal cost through its influence on average cost; and a positively sloping average variable cost curve has a horizontal marginal cost curve.

most unsatisfactory and awkward in depicting decreasing and increasing costs. For outputs of 75, 81, and 86 units, Table 12

shows constant average costs of 93 cents. (Carried to three decimal places, these costs are 93.3, 92.6 and 93.0 cents. For a staunch advocate of continuous series in economic cost and demand, this rounding to the nearest cent is most astonishing!) Thus for outputs of 81 and 86 units, the marginal cost must also be 93 cents. For these three outputs, however, the table shows marginal costs of 71 cents, 83 cents, and $1.00. This fallacious relationship arises from the fact that under the assumptions of the table, one is virtually forced to resort to the tricky and unreliable "average" marginal costs.

Marginal Curves as Indicators of Equilibrium Output

The chief bid for fame of the marginal curves lies in their knife-edge precision in indicating equilibrium output. So at least goes the argument. As a test of performance Figure 7 was prepared from actual data in Table 10. The negatively sloping average revenue and marginal revenue curves were assumed. In no case does the marginal cost curve intercept the horizontal revenue curves or the negatively sloping marginal revenue curve precisely at an interval of output. In all cases the curves cross between the intervals. Which interval, to the left or to the right, is the interval of greatest profit? To answer this question Table 11 was prepared. It is to be noted, without exception, the interval immediately to the left of the crossing marginal cost curve is the one of greatest profit, or least loss. As can plainly be seen in Figure 7, the marginal cost of the interval to the left is less than revenue; the marginal cost of the interval to the right is greater than revenue. Attempts to read the curves at the points of intersection would yield approximations of output, cost, and income. Conclusions as to whether the interval to the left, or the point of crossing would yield the higher profit would be hopelessly entangled. (Accuracy at the intervals may be read in the arithmetical table.) It should also be evident that the practice of moving the marginal cost curve one-half interval to the left would, in many instances, place the marginal curve to the left of the most profitable interval. Thus efforts to "correct" the marginal cost curve may lead to error and confusion.

It should be noted, perhaps, that Figure 7 does not add to the accuracy of Table 10. In that the intervals are in progression, there is nothing in between. Hence, it is erroneous to consider the curves of Figure 7 as continuous.

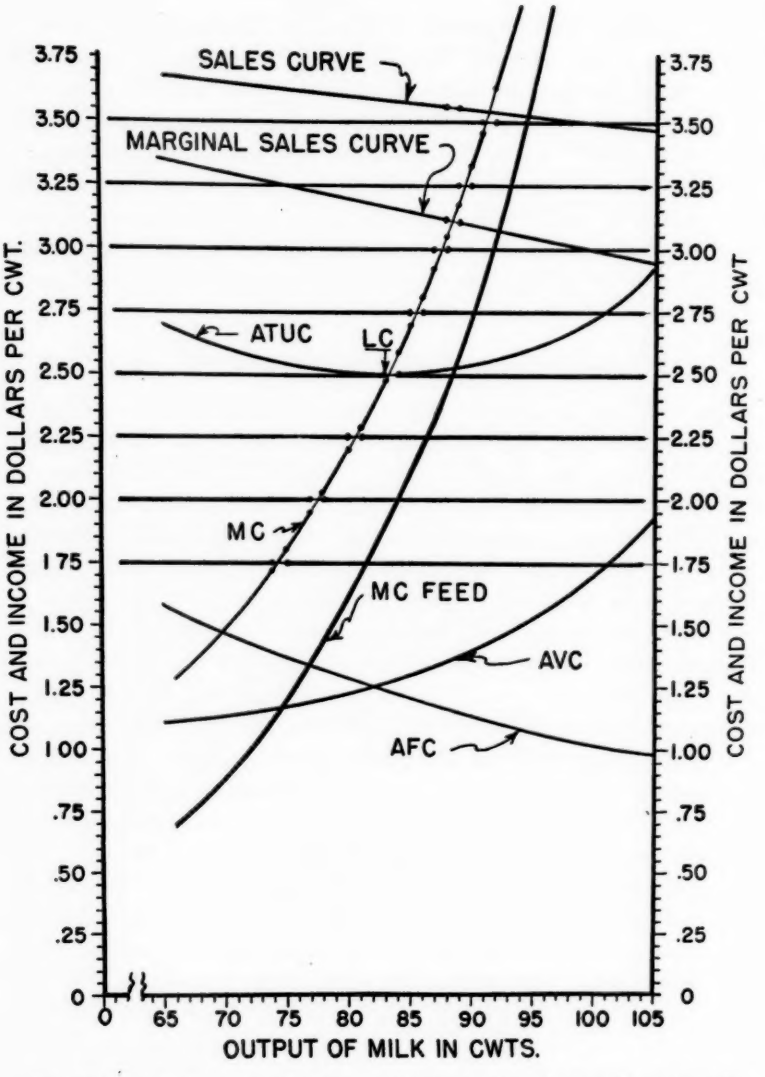


FIG. 7.—Marginal curves as indicators of outputs of greatest profit, or least loss *ATUC*, average total unit cost; *AVC*, average variable cost; *AFC*, average fixed cost; *MC*, marginal cost; *LC*, least average cost. In each instance, the marginal cost curve crosses the marginal sales curves between the 100-pound intervals. The intervals to the immediate left of the marginal cost curve indicate outputs of greatest profit or least loss. In the intervals to the left, marginal costs are less than marginal revenues; in the intervals to the right, marginal costs are greater than marginal revenues.

TABLE 10. COSTS OF PRODUCING MILK IN THE LOS ANGELES AREA PER 100 POUNDS OF OUTPUT

Number of intervals	Total cost	Marginal cost		Average cost			Pounds TDN	
		All items	Feed[1]	Fixed	Variable	Total	Productive	Total[2]
65	$175.14			$1.58	$1.111	$2.69	2311	5231
66	176.43	$1.28	$0.68	1.56	1.116	2.67	2341	5261
67	177.74	1.33	0.73	1.53	1.119	2.65	2372	5292
68	179.18	1.37	0.78	1.51	1.123	2.64	2406	5326
69	180.55	1.43	0.83	1.49	1.127	2.62	2442	5362
70	182.05	1.49	0.90	1.47	1.132	2.60	2480	5400
71	183.60	1.54	0.95	1.45	1.138	2.59	2520	5440
72	185.18	1.60	1.01	1.43	1.14	2.57	2562	5482
73	186.89	1.67	1.07	1.41	1.15	2.56	2607	5527
74	188.56	1.73	1.14	1.39	1.16	2.55	2655	5575
75	190.45	1.81	1.21	1.37	1.17	2.54	2705	5625
76	192.30	1.88	1.28	1.35	1.18	2.53	2758	5678
77	194.20	1.95	1.36	1.33	1.19	2.52	2813	5733
78	196.25	2.03	1.44	1.32	1.20	2.516	2872	5792
79	198.35	2.12	1.52	1.30	1.21	2.511	2933	5853
80	200.63	2.20	1.60	1.28	1.22	2.507	2998	5918
81	202.90	2.29	1.70	1.27	1.24	2.505	3065	5985
82	205.28	2.38	1.79	1.25	1.25	2.5034	3136	6056
83	207.73	2.48	1.89	1.24	1.26	2.5028	3211	6131
84	210.34	2.59	1.99	1.22	1.28	2.504	3288	6208
85	213.02	2.69	2.10	1.21	1.30	2.506	3370	6290
86	215.78	2.81	2.21	1.20	1.31	2.509	3450	6375
87	218.72	2.92	2.33	1.18	1.33	2.51	3543	6463
88	221.83	3.05	2.46	1.17	1.35	2.52	3636	6556
89	224.96	3.18	2.59	1.15	1.37	2.53	3732	6652
90	228.29	3.32	2.73	1.14	1.39	2.54	3833	6753
91	231.80	3.47	2.86	1.13	1.42	2.55	3937	6857
92	235.46	3.64	3.04	1.12	1.44	2.56	4046	6966
93	239.26	3.81	3.22	1.11	1.47	2.57	4159	7079
94	243.25	4.00	3.40	1.09	1.49	2.59	4276	7196
95	247.44	4.20	3.61	1.08	1.52	2.60	4398	7318
96	251.81	4.43	3.84	1.07	1.55	2.62	4524	7444
97	256.48	4.68	4.08	1.06	1.58	2.64	4655	7575
98	261.48	4.96	4.37	1.05	1.62	2.67	4791	7711
99	266.75	5.27	4.67	1.04	1.66	2.69	4931	7851
100	272.44	5.62	5.02	1.03	1.70	2.72	5076	7996
101	278.44	6.02	5.42	1.02	1.74	2.76	5227	8147
102	284.83	6.47	5.88	1.01	1.78	2.79	5382	8302
103	291.79	6.98	6.39	1.00	1.84	2.83	5543	8463
104	299.43	7.56	6.97	0.99	1.89	2.88	5709	8629
105	307.65	8.25	7.66	0.98	1.95	2.93	5880	8800

[1] Total feed cost for 65 cwts: $90.05.
[2] Feed maintenance: 2920 pounds TDN.

Significance of the Interval

Before this discussion is closed, attention may well be directed to the interval and its other dimension, the number of intervals. This is a matter pertaining to the making of tables and graphs that has received too little consideration. The standard units of output are, of course, the pound, the bushel, the crate, the bale, etc. In most instances, these units are too small for analytical purposes. Hence, groupings are resorted to. The interval including a definite

TABLE 11. RELATION OF MARGINAL COST CURVE TO OUTPUT OF GREATEST PROFIT, OR LEAST LOSS

Group	Income per cwt.		Output in cwts.		Total income		Total cost		Net income	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
A	$3.560	$3.555	88	89	$313.28	$316.40	$221.83	$224.96	$ 91.45	$ 91.44
B	3.75	3.75	92	93	345.00	348.75	235.46	239.26	109.54	109.49
C	3.50	3.50	91	92	318.50	322.00	231.80	235.46	86.70	86.54
D	3.25	3.25	89	90	289.25	292.50	224.96	228.29	64.29	64.21
E	3.00	3.00	87	88	261.00	264.00	218.72	221.83	42.28	42.17
F	2.75	2.75	85	86	233.75	236.50	213.02	215.78	20.73	20.72
G	2.50	2.50	83	84	207.50	210.00	207.73	210.34	− 0.23	− 0.34
H	2.25	2.25	80	81	180.00	182.25	200.63	202.90	−20.63	−20.65
I	2.00	2.00	77	78	154.00	156.00	194.20	196.25	−40.20	−40.25
J	1.75	1.75	74	75	129.50	131.25	188.56	190.45	−59.06	−59.20

(1) Output to left of marginal cost curve.
(2) Output to right of marginal cost curve.

number of the smaller units then becomes the standard of measurement. As a counterpart of the interval is the number of intervals to represent a given output. For instance, with three outputs of milk as 7000, 8000, and 9000 pounds, if the interval be 1000 pounds, the numbers of intervals are 7, 8, and 9. If the outputs be 7000, 7500, 8000, 8500, and 9000 pounds and the interval be 500 pounds, the numbers of intervals are 14, 15, 16, 17, and 18. The number of intervals should be in arithmetic progression. With intervals of 1000 and 500 pounds, the average cost of producing 8000 pounds of milk would be the total cost of producing 8000 pounds divided by 8 in the first instance, and by 16 in the second. The marginal cost of 8000 pounds, in the first instance, is total cost of 8 units (8000 pounds) minus total cost of 7 units (7000 pounds); in the second instance, total cost of 16 units (8000 pounds) minus total cost of 15 units (7500 pounds). Intervals and number of intervals handled in this manner eliminate the malpractice of determining average and marginal costs for intervals smaller than those of the given data.

The matter of the interval and the number of intervals gives a clue to the intricacies of the infinetesimal concept. Note in Table 4 that with an interval of 300 pounds, three decimal places are required to distinguish between average cost of the least cost number of interval and the preceding number. With an interval of 0.1 pound, 12 decimal places are required. The drop in cost from the preceding unit of output to the least cost is $0.000000000002. The absurdity of attempts at this degree of accuracy in an analysis of the dairy business should be apparent. The farmer feeds concentrates by measure or by weight. In either case, accuracy does not extend beyond the pound. The milk is weighed to the nearest pound; the butterfat test is read to three decimal places. Purchases of feed and other requirements are rounded to the nearest cent which also applies to sales of milk and butterfat. Any cost and income analysis which attempts accuracy beyond that observed in the various activities connected with the dairy business has very little practical significance.

As for the infinitesimal unit of milk output, the question may very well be raised, How many decimal places are there in the infinitesimal unit? No matter how many places were reached, more could be added. What increase in decimal places would be required to distinguish between average cost of the least cost unit and the preceding unit of output? Furthermore, if the infinitesimal unit could be approached, insurmountable difficulties would arise in attempts to graph the cost curves. Dollar cost on the y-axis would be scaled to infinitesimal units of cost; output on the x-axis would be scaled to numbers of intervals infinitely large. Coping with the infinitely small on the one hand and with the infinitely large on the other would be quite a problem.

The interval has another significance quite as important as that involved in the mathematics of the situation. Economists accept the marginal curves as the instruments for attaining equilibrium output in the real world. The question then arises, What is the unit, or units, of output in terms of which the farmer, the business man, can control and regulate output? This is an aspect of the problem that has been almost wholly neglected. As the dairy farmer adjusts his production program to fit changing costs and prices, to how fine a point may this control be carried? Surely any unit smaller than 100 pounds would be absurd. Even with this unit, the accuracy of attainment may well be several units more, or less, than the goal

set. From this standpoint of the economic problem who would venture to bring up the subject of the infinitesimal unit?

In the actualities of economic activities, the size of the interval for computing costs, particularly marginal costs, depends in large part on the scale of operation. It would seem that the unit of the large-scale producer would be larger than that of the small-scale producer. In each instance, undoubtedly, the size of the interval is controlled by the facts of the case. Theory cannot give the answer.

Conclusions

The location of the marginal cost curve is determined by the total cost curve from which it is derived. The increase in total cost in passing from x to $x+1$ output is dropped to the x-axis at the $x+1$ interval; the increase in passing from $x+1$ to $x+2$ output is dropped to the $x+2$ interval; and so on.

Relations between least average cost and the marginal cost of the same interval are influenced by:

1. The width of the interval; the wider the interval, the greater the difference between least cost and marginal cost.
2. The amount of the fixed cost; the greater the fixed cost, the greater the difference between least cost and marginal cost.
3. The relation between the least cost of the given interval and the least cost of a relatively narrow interval; the greater the deviation to the left, the greater the difference between least cost and marginal cost; the greater the deviation to the right, the less the difference between least cost and marginal cost.

In the real economic world in which business men are continually confronted with the problem of adjusting output according to the cost and price situation, the well-established principle Marginal Cost=Average Cost, at Minimum Cost is in error. The marginal cost of the least cost interval is always less than least cost. In passing from average cost of the preceding unit of output to the least cost interval, three rectangles are involved: the one in common; the one substracted; and the one added. The net increase in area, or total cost, is the rectangle added less the rectangle subtracted. Thus the cost of the least cost unit represents more than the net addition to total cost. This explains the peculiar persistence of the marginal cost curve to cross the average cost curve to the right of least cost.

The equilibrium output indicated by the crossing of the marginal

curves, is the interval on the marginal revenue curves, horizontal or negatively sloping, immediately to the left of the crossing marginal cost curve.

All analyses of cost relations as expressed in tables and graphs should be in terms of intervals in arithmetic progression. Thus the fallacy of the "average" marginal costs would be avoided.

The marginal unit of the business man is that amount of output in terms of which he can control and regulate his output.

A NEW SYSTEM OF FARM ACCOUNTING

A. L. JOLLY
Imperial College of Tropical Agriculture, Trinidad

LITTLE progress has been made in the practical application of orthodox accounting to the farm. The trend in farm bookkeeping today is for more farm records and more "simplified" *account* books. The word "account" is purposely written in italics because the majority of simplified account books are more in the nature of record books than books for orthodox accounting; in these books the expenditure and income under various headings are not arrived at by checking back to cash and credit purchases and sales as in orthodox accounting.

Accounting proper has developed little on the farm from a combination of two causes: first, conventional accounting is a special and somewhat laborious process and requires a degree of clerical skill not usually available on the farm; second, farm management economists have stressed the value of cost and other complicated accounts designed mainly to present agricultural information without stressing sufficiently the value of all accounting. The combination of these two causes has led to the position that only the few farmers who can employ an adequate office staff can hope to keep complicated accounts successfully by conventional methods.

Actually, accounts far less complicated than costings can be most valuable to the farmer in operating his farm, not perhaps in making him directly a better farmer but certainly in making him a better businessman. Accounts in business are kept and used to check wastage and to provide proven information. If wastage is liable to occur in business, wastage and misinformation are certain to arise on a farm. Indeed the process of checking facts on a farm by means of accounting should come before any but the most error-proof record keeping. For instance, a record purporting to show economical feeding of livestock has little meaning and can be downright misleading when it is based on the farmer's impressions or instructions of what is to be fed; for such a record to have any usefulness the feed consumption must be arrived at by an allocation of the total purchases. The accounting process is not carried out, as is sometimes assumed, entirely to obtain information more accurately; the detection of wastage itself corrects misconceptions about the operation of the farm and should result in more careful and busi-

nesslike operation of the section in which wastage is being detected. In short, accounts give control on the operation.

However logical and desirable it may be theoretically to develop farm bookkeeping by the development of farm accounting, the practical difficulty of clerical labour and skill still remain. The writer has devised and is testing the system of accounting described in this article in the hope of overcoming these practical difficulties. The reader may obtain the initial impression that the system as described would be beyond the grasp of any farmer; this impression is created by the fact that at this stage it is desirable to explain the principles of the system without illustrating all the applications of any particular principle. Indeed this article is not intended for the farmer but for the farm management economist who is always faced with the unsatisfactory state of most farmers' books. Research on the system by the economist will determine how best the system can be installed and developed on a particular farm.

Elements of the System

The system consists essentially of double entry accounting on statistical cards. In place of the conventional double entry procedure of entering the value of a transaction in both the appropriate accounts, on the card the value is entered once and the two accounts are identified. The visual comparison of conventional double entry posting and the same transaction entered on a card is given in Figure 1. It will be seen that on the card the convention is adopted of entering the account that would carry the debit entry on the left hand, debit side, of the card; the account that would carry the credit entry on the credit side of the card. All transactions therefore move across the card from right to left. It has already been proved that persons with no experience of double entry bookkeeping quickly become accustomed to the value movement on the card and to the fact that every transaction is a movement of value.

The cards are perforated round the edge to permit clipping and sorting. Clipping is effected by a simple hand punch that cuts a V-shaped slot in place of the perforation. The cards are sorted by inserting a needle, similar to a knitting needle, through the perforations. On raising the cards and shaking them gently, those clipped for the code sorted fall out. This sorting system is at present protected by patents and is fully described in leaflets issued by the

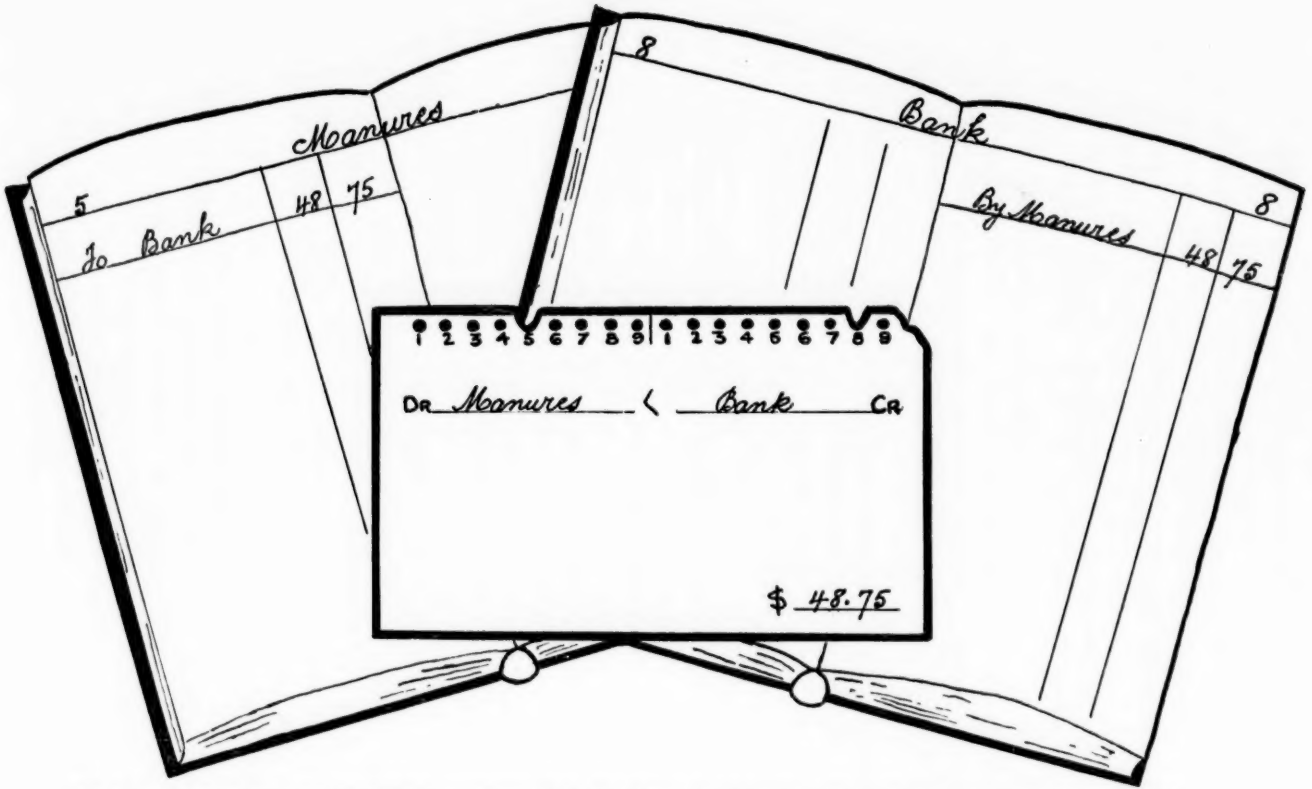


FIG. 1. COMPARISON OF CARD AND LEDGER ACCOUNTS. N.B. Not drawn in proportion: the card measures approximately 3″×5 .

manufacturers. Cards can be made to any size and design, in various weights, and in seven different colours.

This sorting system is particularly suitable for farm accounts because unlike punch card systems the cost of operating equipment is negligible. Apart from the cards themselves, the equipment for

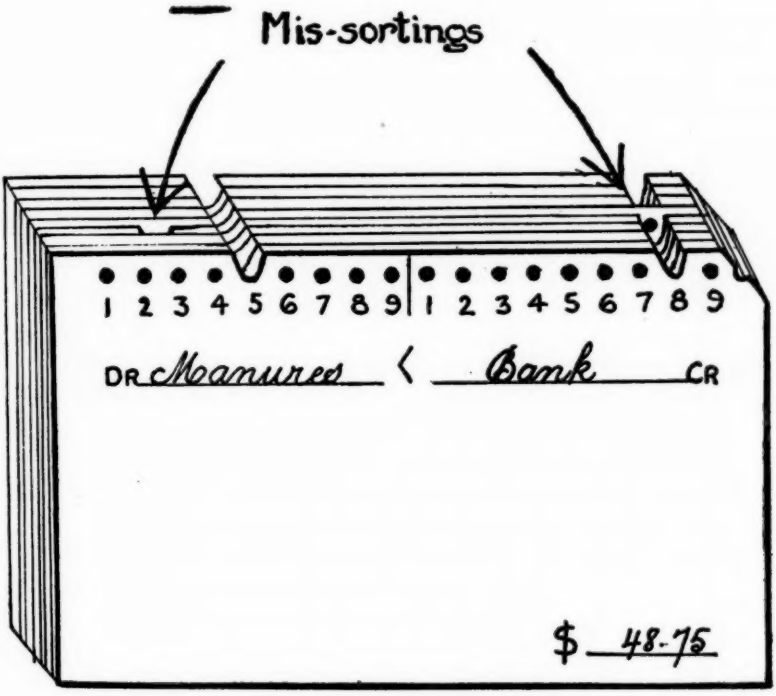
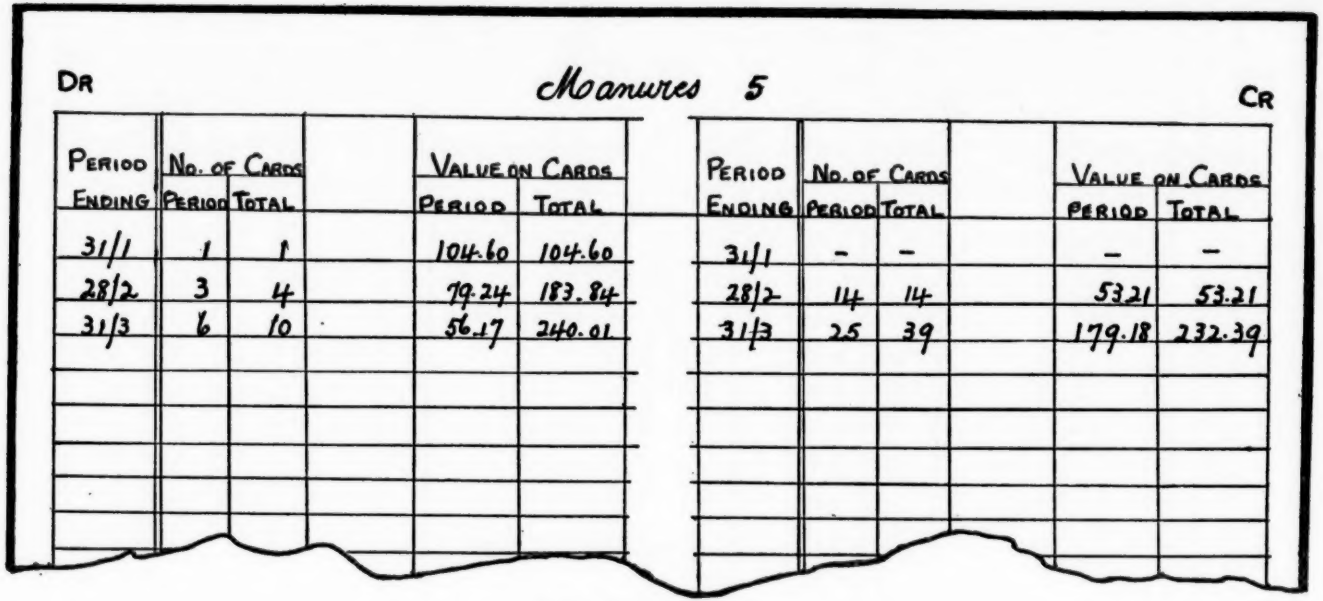


FIG. 2. VISIBLE CHECK ON SORTING OF CARDS.

handling them (1 hand clip and 1 needle), can be obtained for less than $3. Although the sorting procedure is not mechanical and human error is possible, the clippings on the perimeter of the card give a visible check on the accuracy of any sorting or classification (Figure 2). This visible check makes it usually unnecessary to needle-sort every card from a classified file to obtain any particular group or range of transactions; an initial selection of some sections can be made by eye.

The essence of the card is therefore the single entry of value and



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Period Ending	No. of Cards: Period	No. of Cards: Total	Value on Cards: Period	Value on Cards: Total	Period Ending	No. of Cards: Period	No. of Cards: Total	Value on Cards: Period	Value on Cards: Total
31/1	1	1	104.60	104.60	31/1	–	–	–	–
28/2	3	4	79.24	183.84	28/2	14	14	53.21	53.21
31/3	6	10	56.17	240.01	31/3	25	39	179.18	232.39

FIG. 3. THE TOTALS BOOK.

of the two accounts concerned in the transaction. When a card has been clipped, the bookkeeping theoretically is complete; for instance, to obtain cash purchases, sort all cards for Cash on the credit side and total the amounts on the cards. If it is required to analyze these purchases, sort them by the Debtor side and total each component heap. In practice, however, some form of control is required to reconcile accounts and to prevent mis-sorting or mis-adding of cards. Control is achieved by a Totals Book (Figure 3). This book takes the form of a ledger in carrying accounts with Debit and Credit entries. As the name implies, these entries represent the total amounts on cards of that entry for the appropriate period. The Totals Book is entered by sorting all the cards for a period by, say, Debit side and entering the total of each account pile on the left-hand page of the appropriate account in the Totals Book; when all groups have been totalled, the cards are re-sorted by the Credit side and the corresponding Credit entries made in the book. The Debit entries are then totalled from the book and entered in a final Totals Account, similarly Credit entries. The Totals Account must, of course, balance exactly since it represents the total of the group of cards for the period added twice over. It will be seen that the number of cards is also entered in the Totals Book; the reason is that in any subsequent analysis the sorting can be much more readily checked by counting the number of cards than by totalling the amounts. The number of cards on both sides of the Totals Account must also always balance.

The Totals Book serves as a necessary control but it provides evidence of correct reconciliation and a potentially valuable summary on the progress of accounts; cumulative totals are entered alongside period totals to indicate progress clearly.

Advantages of the System

Before confusing principles by describing some of the refinements of the system it is desirable to point out some of its advantages. Advantages arise from the facts that the system is essentially double entry accounting and that it makes use of sortable cards.

The inherent advantage of double entry accounting, that is the tracing of transactions directly from the known facts of purchases and sales, is, of course, retained in the card system. An additional advantage that is also retained is flexibility. Flexibility in accounts is required so that when control over certain sections is obtained

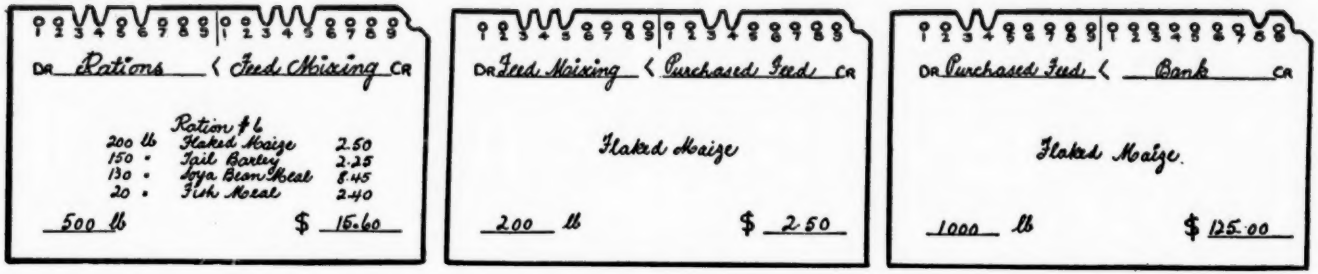

FIG. 4. TRACING TRANSACTIONS THROUGH FOUR ACCOUNTS.

and the good management of that section becomes correspondingly easier, new accounts to give checks on other sections can be introduced. As control over the financial and then the business sides of a farm is achieved, new accounts will concern more agricultural details. These agricultural details can and should be entered within the accounting framework so that all information is available from one uniform source and all information is subjected to uniform checking. As an example, there is no essential difference between the service of a cow and the purchase of feeding stuffs; both and all other agricultural details worth the work can be entered in the card system.

The cards themselves have the advantage of eliminating ledger posting and other processesses of digesting the original entries to make them suitable for final entry. All such processes demand clerical labour and skill without which the reconciliation of accounts becomes a hopelessly difficult undertaking. On the card the whole of the information of the original entry, including quantity, quality, price, conditions and even comments, can be entered and is thus always available by a single reference. In book accounts such information can only be laboriously extracted by cross reference to subsidiary books.

The cards lend themselves to tracing transactions through more than two accounts. Suppose, for example, in order to check feeding stuffs which are purchased in bulk and mixed on the farm into rations a system of keeping a "Feed Mixing" and a "Rations" account was maintained. Transactions can be traced from the original supply to the final ration as shown in Figure 4.

Cards eliminate tabulation. Complicated tabulation to accumulate the number of small transactions to a postable total requires clerical skill to enter and check. With the cards any particular group or field of transactions can be segregated and entered or examined without any confusion of adjoining columns or lines. Thus, the entering and checking of such transactions is easier on cards than in tables.

The sortability of cards makes it possible to use an individual card in every analysis to which it applies without abstracting or in other ways transcribing the entry to other books. For instance a card representing the milk yield of an individual cow for a month can be used by amalgamation with other cards for the rest of the herd to obtain the herd production for the month which will be

DR Count 3 CR

Period Ending		By Totals Book	By Cards
31/1		89	89
28/2		78	78
31/3		104	104

Period Ending		By Totals Book	By Cards
31/1		67	67
28/2		51	51
31/3		86	86

FIG. 5. TOTAL COUNTS BOOK.

checked against the disposal of milk for that period. The same card can be amalgamated with all other yield cards for the year to prepare statistics of herd performance for the year, or it can be used with other cards for that cow only to arrive at the cow's performance for the year. By resorting, the card can be used to obtain the lactation yield of this cow to compare with other lactations of the same cow or similar lactations of other cows; by resorting again, it can be used to examine the monthly variation in production of all cows or of cows that have calved about the same time of the year or cows of similar age or breeding; by resorting, the card can be used in analyses of monthly production of milk to compare similar months in previous years for this or other cows; and so on. All these analyses can be obtained without any written tabulation whatever, but merely by sorting cards into groups and adding each group. In fact once the information has been clipped on the card it becomes permanently available to be used in every possible statistical context.

Refinements in the Card

(*a*) *Clipping*

The fact that Account perforations are numbered 1–9 does not imply that a maximum of only 9 accounts is possible. By coding Accounts with one or more clippings vastly more alternatives are available. It has been found that more than 4 clippings to code an account is undesirable as being difficult to carry mentally from an index to the card. With no more than 4 clippings it is possible to obtain 256 combinations of account codings from the 9 perforations! It is not suggested that any set of farm books would consist of so many accounts but the large number of alternatives allows for convenient groupings of codes; for instance Crop accounts might all commence with the prefix 1 and thus facilitate the segregation of transactions relating to crops from those relating to say livestock.

The multiple coding of Accounts makes correct entry in the Totals Book somewhat more difficult. The difficulty is not in arriving at balancing totals or of allocating large groups of cards to their correct Accounts but in allocating small groups of up to six cards when complete needle sorting appears to be unnecessary. It is very easy, for instance, supposing there are four cards clipped 7 and one clipped 7, 8, to enter all five in 7 because the group was not sorted by needle. Such errors must be prevented if the Totals Book is to be a sound control on the cards. A satisfactory auto-

matic check on this class of error can be made by constructing nine Totals Counts as shown in Figure 5. The procedure is as follows: when the Totals Book has been compiled, the number of cards on, say, the Debit side of all accounts containing the code 1 are totalled and entered in the Dr. side of the Totals Count for 1; similarly all accounts containing the code 2 are totalled and entered in the Totals Count 2. Subsequently the cards are sorted one needle at a time and the number of cards counted and entered adjoining those prepared from the Totals Book. It is unnecessary to consider money values in the Totals Count since the balancing of the Totals Book is evidence that the value of the cards has been correctly added although possibly wrongly allocated. The counting of large numbers of cards can be conveniently carried out by weighing 25 or any other convenient small number on an ordinary domestic letter weight.

(*b*) *Details within Accounts*

It will be seen in the example of a more detailed card (Figure 6) that perforations 0 to 9 appear on the right hand side of the card. These perforations are used to identify Details within Accounts. By

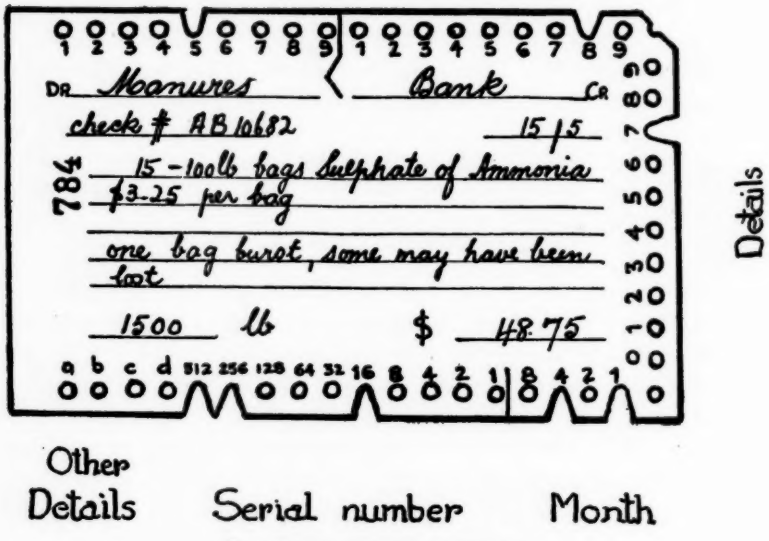

FIG. 6. FULL DETAILS OF THE CARD.

the use of Details it is possible to introduce a sub-classification within the Accounts. This principle of having two levels for allocating transactions, first in the broad Account groups and second, in the Detail groups, is an integral feature of the system because it has definite advantages over the one level system of allocation.

The first advantage is that it is possible to have a Totals Book (being divided by Accounts only) which is a summary check on a period of transactions and not the laboriously elaborate abstract of the whole allocation information on the cards; a Totals Book that contained a separate page for every detail within every Account would be so voluminous in even a moderately complicated set of accounts as to be unmanageable. The second advantage of Details is that many Accounts can be amplified by means of Details with no disturbance of the original Account coding. The third is that Details facilitate correct clipping because Accounts can be clipped quite independently and in a different operation from Details; furthermore many Details are common to more than one Account (for instance classes of cultural operations on all arable crops) so that Details clippings can remain uniform throughout all such Accounts.

Since each card carries two Accounts, the Details range tends generally to be split into two groups: one group for instance, 4 to 0 referring to one Account and 5 to 9 referring to the other, each having 31 alternative clippings. Some ingenuity has to be exercised in deciding Details codings so that transactions do not occur between Accounts that both have the same Details range. If it is impossible to avoid duplication of Details clippings with certain transactions that are fairly common two possibilities are available: (1) to split one of the Accounts into separate Accounts for each Detail; (2) to use the other Details clippings a, b, c, d (16 combinations) for recording the Details in one of the Accounts. If duplication arises only occasionally with an unusual transaction it is possible to split the transaction between two cards using a dummy Divisions or Transfers Account.

(*c*) *Date, Serial Number, Etc.*

The card carries a clipping for the date of the transaction so that cards can be needle sorted into the totalling periods to which they belong. If the totalling period is one month the month clipping as

shown in Figure 6 is sufficient. It will be seen from the figure that the month is clipped factorially; for example, May, month 5, is clipped 4, 1. This factorial system of clipping economizes in perforations and with a little practice becomes second nature to the operator.

The serial number clipping along the base of the card need be of

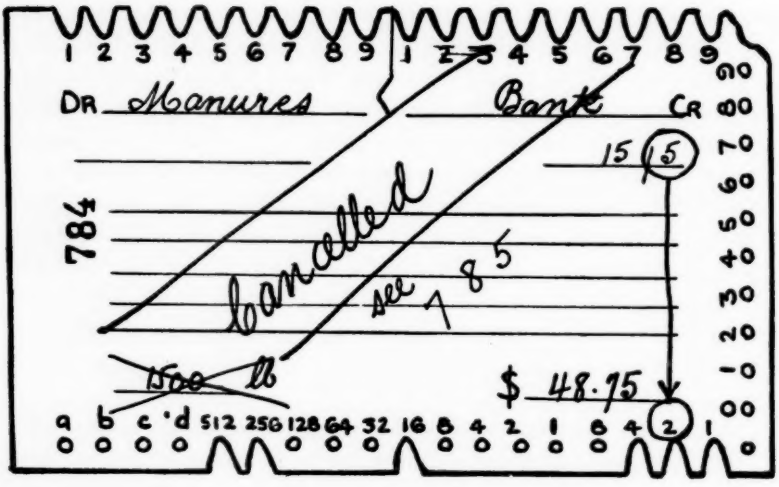

FIG. 7. CANCELLED CARD.

little concern to the user of the card since series of cards can be preclipped before being issued. The object of such clipping is merely to protect against loss or theft of cards and to facilitate the detection of such loss. The clipping makes it possible to trace the actual number of the card lost which no doubt would give a clue to the date and nature of the transaction from the contiguous cards; the clipping, of course, also prevents alteration in the printed serial number of the card.

Because it is necessary to account for the whole supply of cards used it is not permissible to destroy a card on which some error has been made. The standard method of cancelling a faulty card is shown in Figure 7. A "Cancelled" account should appear in the Totals Book recording these transactions in the same way as any other.

(d) Cumulative Cards

It is possible to accumulate a number of small repetitive transactions on a card of the type shown in Figure 8. Such accumulation is desirable for these transactions in economizing in the consumption of cards and the entering and clipping of them. It must, however, be realized that cumulative cards require more skill in entering

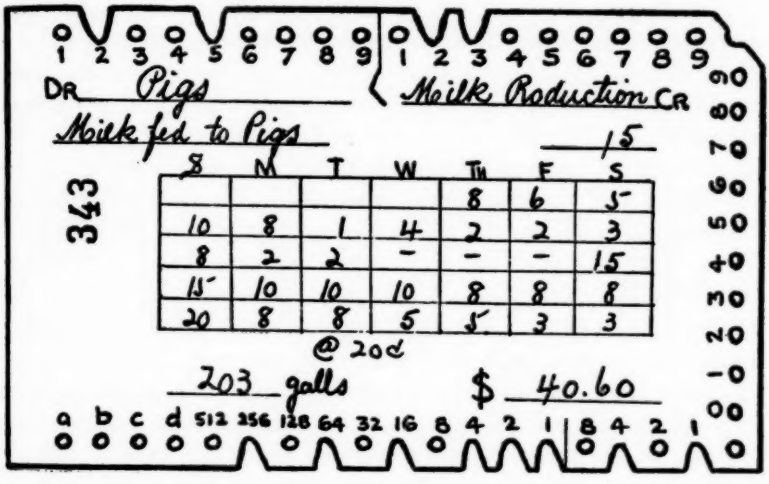

FIG. 8. CUMULATIVE CARD (ONE MONTH). Daily entries made alternately in red and blue ink.

than the simple one entry card. Cumulative cards are in fact simple tabular statements and have the disadvantages of tabulation.

The period of accumulation for this type of card should be the natural period for the transaction concerned; transactions connected with sales or purchases can be best accumulated on a month card since billing is normally monthly; transactions relating to wages should be accumulated on weekly cards if labour is paid weekly.

Many cumulative cards gain in usefulness if they can be displayed and entered upon a board. A plywood board carrying rows of short cabinet tacks at suitable intervals to hang the cards by their perforations is suitable. A more flexible board used by the writer consists of overlapping plywood slats carrying nails along the edge; the overlapping slats prevent the cards from being blown

off while allowing the easy removal and re-arrangement of the display. A display board gives a visual representation of the phase of operation of the farm shown by the daily accumulation and facilitates the correlation of associate transactions. For instance, in a labour display the operation of applying manure suggests a card for the issue of manure; or in a milk production display, a card showing a cow coming into milk suggests one for the birth of a calf. The daily entry of quantities on these cumulative cards also draws attention to daily variation which may be of great importance.

Checks on the daily entries on the cumulative cards are made possible by entering alternately in red and black ink; with such alteration it is possible to arrive at daily totals direct from the display board with reasonable accuracy. The use of different coloured cards assists in carrying the eye down the appropriate columns and also facilitates accurate checking.

(*e*) *Summary of Cards*

Many cards require little or no written explanation of the transaction they represent, and the body of the card can be used for summarizing past transactions concerning that particular Account or particular Detail. Valuation cards are particularly useful in this respect. For instance, Figure 9 shows a valuation card for an individual cow with her past lactation records entered upon it. A

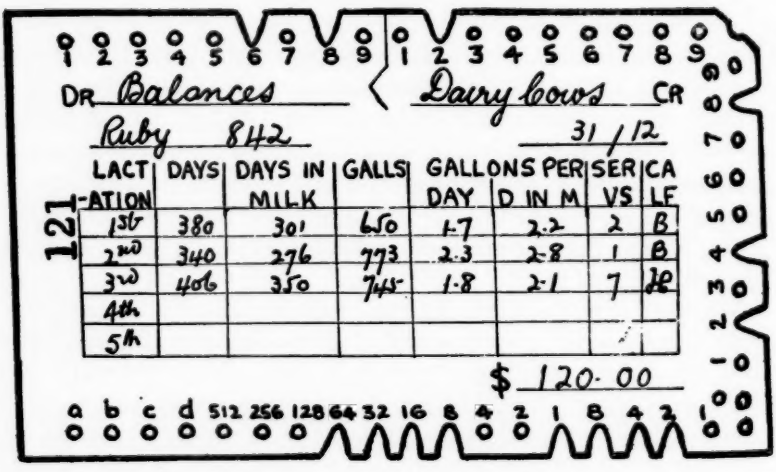

FIG. 9. SUMMARY (ON CLOSING VALUATION) CARD

group of such cards for the whole herd can be filed perhaps in order of merit so that the farmer can have the latest assessment of the efficiency of the individual cows always at his finger tips. It may be noted that all the information summarized has, of course, already been recorded on various transaction cards. Lactation or any other records are in fact a summary of certain card transactions which will certainly be required in some standard form.

A rather different but equally useful summary concerns balances. The normal procedure of recording a balance is by using a Balances Account as shown in Figure 9; it is necessary, however, to use two cards, one for the closing balance as in Figure 9 and a similar one with the accounts reversed for the same balance opening the new period. This procedure is satisfactory in recording valuations and striking Balances that have to be carried from the end of one financial year to the beginning of the next, but it is objectionable as being wasteful of cards and work when a balance is struck during the year and particularly when it represents merely a book balance and not actually a stocktaking. It is convenient, therefore, whenever book balances are struck to record this balance not as a transaction but in the body of a balance card recording an actual stocktaking.

(*f*) *Labour Saving*

Cards permit labour saving from the fact that they can be kept available at the most convenient points on the farm and that they require no fine hand writing for the first entry. An example of having cards readily available is in the Cash Box; if cards are kept in the box, preferably different colours for receipts and withdrawals, and preferably prestamped and preclipped Dr. Cash and Cr. Cash respectively, the labour of entry is small. An entry written in pencil on the body of the card, for instance, "Curry Combs $4.60" is sufficient to identify the transaction. Another possibility of having cards available is for the farmer to carry a loose leaf notebook with filing rings suitable for the card perforations; he can then jot down diary fashion any transaction or other matters as and when they occur to him.

Cards can sometimes be used for automatic stock checks; they can be pre-stamped and pre-clipped for convenient quanities of supplies and can be filed in the store room as supplies are received. When supplies are issued from the store an equivalent number of

cards are withdrawn and either entered with the account to be charged or deposited in another container representing that particular account. A similar system can be applied to livestock by using valuation cards as counters for individual animals; these cards can be filed or displayed probably in the farm office in such a way as to indicate the position and condition of every animal; for instance, suckling sows can appear in one section, dry sows in another, fattening pigs in another, and so on. An automatic check is thereby kept on stock numbers and movements with very little labour; this check facilitates the calculation of rations, arrangement of services, etc.

Labour can also be reduced by using duplicate books for various purposes bound in such a way to give a carbon copy on the card. Such books can be used for check books, receipt books, sales slip books, etc.; the process of making out the original document suffices to give all the required information for clipping the appropriate card. On large farms employing much labour for which there is considerable delegation of authority the duplicate book system can easily be applied to issuing and recording written orders.

Conclusion

An attempt is made in this article to outline the principles of the clip-card system of accounts as applied to farms. It will be appreciated that it is impossible to describe much of the detailed application of such a flexible system to various types of farms. Every farm and every farmer require a different framework of accounts if the maximum benefit is to accrue from the minimum accounting labour. The writer's experience of the system so far has, however, led to some general conclusions.

It appears that any transaction worth noting can be entered in a uniform way on the cards. It does not matter whether the transaction concerns the outside world or whether it is a purely domestic transfer on the farm; neither does it matter whether the transaction is of a determinable value or whether it is to be valued on some arbitrary basis. All transactions can be entered on cards and are more explicit and uniform for being so entered.

Indeed an obvious result of the use of the card system is the more precise appraisal of transactions. Every card demands clear cut decisions; from the diary entry on the body of the card, the card clippings have to be decided and a clipping is either yes or no with

no middle course. An accumulation of these enforced decisions results in more precise distinction being made in the classification of transactions.

Due no doubt to the increase in precision of appraising transactions it is found that the user of the cards becomes more critical of established procedure on the farm. Methods which without special thought seemed normal and efficient often appear most unbusinesslike when translated into card transactions. It has happened that to to make an operation convenient for entering on cards a change in procedure on the farm is desirable; it then becomes obvious that the new procedure is far better management than the old.

One difficulty experienced with the system is that the scope is so wide and the possible useful applications on a particular farm so numerous that there is the temptation to undertake too much detail at the outset. The success of any system will depend on keeping the scope at all times restricted so that the farmer has complete control over the accounts he is keeping. If a simple set of accounts arouses the farmer's interest in accounting and stimulates his critical appraisal of his farm and business management, a solid foundation is then laid for accounts of slowly increasing complexity.

IMPACT OF THE WAR ON UNITED STATES FLOUR CONSUMPTION

WILLIAM O. JONES
Food Research Institute

THE history of per capita consumption of wheat flour in the United States points to extraordinary stability in the absence of such major shocks as great wars or great depressions. While there has been a substantial fall of per capita consumption over the past half a century and more, the major reductions up to World War II were recorded only twice—dramatically in 1917, when it fell by about 10 percent within, apparently, a few weeks; and less spectacularly in the early 1930's when it fell by about 12 percent in a period of five years.

Observers of American flour consumption have been anxious to know if the shock of World War II and its aftermath has produced similar results. Informed current opinion commonly records the impression that per capita flour consumption rose sharply in the early part of the war, and then fell rapidly to a new low level in the immediate postwar period. Yet careful examination of available statistics indicates that, great as the latest shock to the American economy has been, American flour consumption per capita during the war years and through July–June 1946–47 cannot be shown to have differed perceptibly from its previous level.

I

The course of United States flour consumption from 1879 until 1933 was clearly and accurately defined by Holbrook Working in a series of three articles in *Wheat Studies of the Food Research Institute*,[1] and the series was brought down to 1935 by his revision of census estimates for that year.[2] As a result of critical and detailed examination of flour statistics, Working was able to demonstrate that, (1) though per capita consumption of flour declined over 20

[1] "The Decline in Per Capita Consumption of Flour in the United States," *Wheat Studies of the Food Research Institute*, July 1926, II, 265–92; "Statistics of American Wheat Milling and Flour Disposition Since 1879," *Wheat Studies*, December 1927, IV, 63–102; "New Data on United States Flour Production Since 1899: By States and by Sizes of Mills," *Wheat Studies*, April 1936, XII, 273–312.

[2] "Wheat Milled and Flour Production in the United States, 1931 to 1937," in J. S. Davis, "The World Wheat Situation, 1936–37: A Review of the Crop Year," *Wheat Studies*, December 1937, XIV, 159–60.

percent between 1900 and 1934, the income and price elasticities of flour were so small as to be negligible, and (2) the effects of American participation in World War I and of the Great Depression somehow influenced flour consumption strongly in the same direction, producing, or at least accelerating, a decline to a new, relatively stable level.

These investigations are of interest not only because they established reliable data about the consumption of a great staple food, but also because they developed techniques for obtaining results of excellent precision from statistics that by themselves are incomplete and of varying degrees of reliability. Although all that is required in the present inquiry is the measurement of a magnitude over time, four knotty problems, of a rather general occurrence, had to be solved:

1. It was necessary to estimate the reliability of enumerations intended to be exhaustive in coverage, and to make appropriate corrections for deficiencies.
2. Estimates of total magnitudes had to be made from surveys that covered a varying (though high) percentage of the firms contributing to the total.
3. Some values, for which no reliable estimates whatever existed, had to be estimated on the basis of general economic knowledge.
4. Statistics collected under abnormal conditions of war had to be brought into adjustment with peacetime statistical series.

In the present study I have attempted to use the methods developed by Working to bring up to date the estimates of total and per capita flour consumption in the United States. It seems worth while, therefore, to review the procedure he used in developing accurate estimates of flour consumption for earlier years, in particular for the period 1923–1935. This will serve to illustrate the devices used to rectify the statistics and will also suggest the problems involved in bringing the series up to 1947[2a]. For the period from 1879 to 1923 somewhat similar methods were used, but the procedure differed considerably in detail because of the nature of the statistics for that period.

[2a] I had hoped to have figures for the crop year 1947–48 in time for inclusion in this article, but now, early in August 1948, when the article is in galley proof, it is still not possible to carry estimates beyond July 1, 1947. Foreign trade statistics for April-June 1948, and flour production for June 1948 of mills reporting monthly, may be released within 30 days; but, as a result of the reduced appropriation granted the Bureau of the Census for the fiscal year 1948, no information on 1948 production of flour in mills with daily capacity of 400 sacks or less will be available until late in 1949.

II

The annual flour consumption which it is sought to measure is the total quantity of wheat flour[3] that disappeared within the continental United States in a 12-month period.[4] It can be defined as total United States flour production, measured at the mill, less net exports and shipments outside the continental United States, and plus or minus changes in domestic stocks. Per capita flour consumption is total annual flour consumption divided by the average population[5] in the United States during the year. For the period 1923–35, Working found that official figures on exports and on shipments outside the continental United States were satisfactory. His attention was principally concentrated on estimates of total flour production and of changes in flour stocks.

Production.—Two sources exist for estimates of flour production for the period since 1923: decennial and biennial censuses;[6] and voluntary reports made monthly by the flour mills. The censuses attempted to achieve complete coverage of all commercial mills; monthly milling reports were prepared voluntarily by mills producing in excess of 85 percent of total flour production.

There were several defects in the census figures.[7] For reasons of economy the canvass was restricted to commercial mills with an annual product valued at $5,000 or more. This meant the exclusion of all "custom mills,"[8] as well as of mills with a production valued at less than $5,000, and in practice involved omission in some censuses of many mills doing a business of appreciably more than $5,000 a year. In addition, the reporting periods which the mills used were not identical; during the past twenty years, at least, a number of large milling establishments have reported for their own fiscal years rather than for the calendar year. Moreover, separate reporting of "prepared flour" in the census returns introduced a possibility of duplication.

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[3] Including whole wheat and semolina, but excluding, during the recent war, granular flour milled for alcohol production.

[4] Although from the standpoint of nutrition measurement of actual ingestion might be more appropriate, for the purposes of economic analysis the quantity of flour entering the distributive channels seems a more significant magnitude.

[5] Regardless of age or sex. Cf. p. 530n.

[6] U. S. Dept. Comm., Bur. Census, *Population* (decennial); *ibid.*, *Census of Manufactures* (biennial from 1923 to 1939).

[7] See Working, *New Data on United States Flour Production Since 1899* . . . , p. 274.

[8] Defined in the *Census of Manufactures* as mills doing wholly a custom business.

To provide statistics applicable specifically to calendar years, and free of possible duplication from separate reporting of prepared flour, the Bureau of the Census prepared special tabulations of flour production for 1929, 1931, and 1935.[9] In these tabulations, production statistics were taken as far as possible from the monthly milling reports, and to them were added the census production figures of mills which had not reported monthly. The results, in sacks,[10] compared as follows with the census totals:

Compilation	1929	1931	1935
Biennial census	235,277,759	226,118,977	200,561,385
Special tabulation	237,526,461	222,224,957	200,740,209
Difference	2,248,702	3,889,020	178,824

Other methods were required in order to measure the fluctuations introduced by exclusion of small mills and custom mills. The procedure followed in making this adjustment is described in detail in Working's 1936 study.

Only after appropriate corrections had been made did the *Census of Manufactures* prove to measure production satisfactorily for the calendar years in which it was taken. In order to have estimates for other years, and for parts of years, it was necessary to obtain consistent estimates of total production from the monthly milling reports. Of their kind, these reports were excellent. Monthly reports made by individual mills were probably more accurate than annual reports made for census years, and the reporting periods were uniform. Coverage was high. In the early years the reporting mills produced over 85 percent of all flour produced, in the later years over 95 percent. But even when coverage was near or over 95 percent, it might vary appreciably from year to year. This variation could introduce a serious error into estimates of consumption.

It had been customary to raise the monthly milling report figures to 100 percent by assuming that reporting mills currently produced the same percent of total production as they had in the previous

[9] See Working, *New Data on United States Flour Production Since 1899 . . .*, p. 311; *Wheat Milled and Flour Production in the United States, 1931 to 1937*, p. 159.

[10] Conversion to sacks of 100 pounds from the original units is made at 196 pounds per barrel.

census year.[11] But this method consistently yielded estimates of total output that were too high.[12] By comparison of monthly milling reports with the corrected biennial censuses, Working developed a correction for this bias and was able to obtain consistent monthly estimates of production.

Stocks.—There are no estimates of total stocks of flour in the United States. Such estimates of flour stocks as exist cover only *primary commercial stocks* and represent chiefly flour passing through trade channels to bakers, retailers, and exporters at a fairly uniform rate. It was necessary to estimate indirectly the magnitude of changes in stocks. By a careful examination of monthly net retention figures, Working was able to set approximate limits for these variations, and was also able to compare the variations for various 12-month periods. His conclusion was "that a change of 2 million barrels [approximately 4 million sacks] between successive January's is not uncommon and that under extreme conditions the change may be several times . . . "[13] as large, whereas "changes in stocks appear to be usually much smaller between corresponding dates in midsummer than between corresponding dates in midwinter. . . . "[14] (Changes between January and July might run as high as 22 million sacksl) Stock changes between successive July's generally were less than 2 million sacks. Exceptionally, flour stocks in July 1933 were built up to a level nearly 8 million sacks above that of July 1932 in anticipation of imposition of the processing tax.

With revised estimates of production, and with new knowledge of stock changes, it was possible to estimate total consumption *for July-June crop years*[15] with an error of something less than 1 percent. It was also possible to demonstrate statistically the in-

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[11] Another device which has been used by some is to base estimates on the reported production of a group of "identical" mills. Such estimates tend to have a smaller bias than crude estimates based on production of all reporting mills, but the bias, Working found, was erratic and incapable of satisfactory correction.

[12] Working, *Statistics of American Wheat Milling and Flour Disposition Since 1879*, pp. 68–69, "with new concerns being established each year and old concerns going out of business, any large and representative group of concerns in operation during a given year tends to produce a larger proportion of total output in that year than in a previous year; such a group naturally contains some concerns that were not in existence in the previous year and of course contains none of the concerns which have gone out of business . . . " *Ibid.*, p. 69.

[13] *Ibid.*, p. 74.

[14] *Ibid.*, p. 75.

[15] Stock changes between Januarys were so great as to make calendar-year estimates much less reliable than crop-year estimates.

sensitivity of flour consumption to changes in prices and consumer income.

III

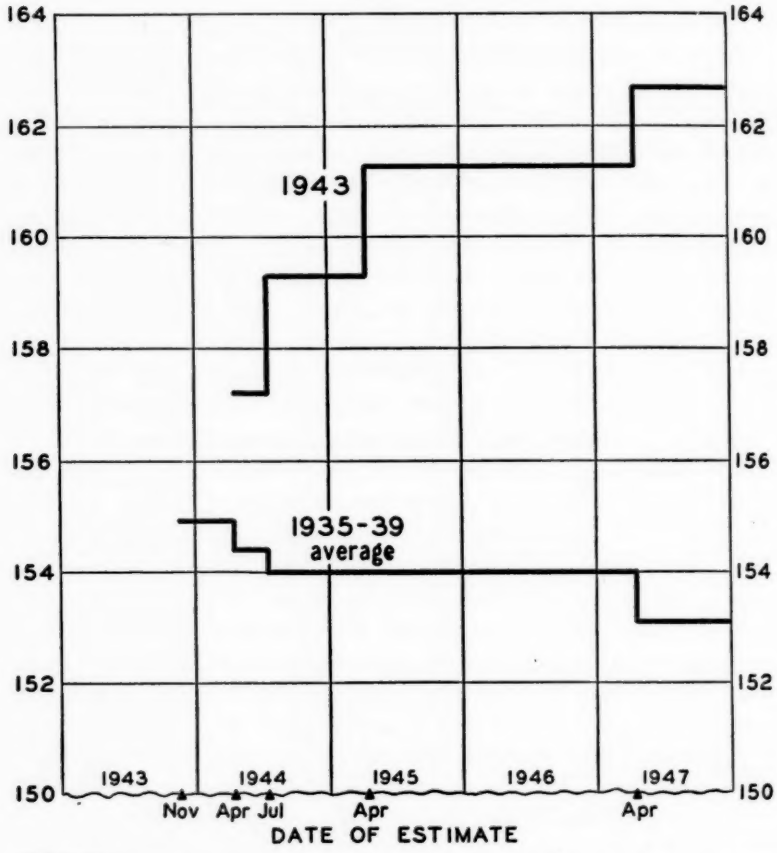
With the evidence already before them of the reaction of flour consumption to the shocks of World War I and of the Great Depression, it was natural that students of flour consumption should expect substantial changes to be associated also with World War II. Published estimates of per capita flour consumption[16] *on a calendar-year basis* appear to show a sharp increase in consumption during 1940–43, from 147.4 to 162.7 pounds, or about 11 per cent. That some of this change should be attributed to changes in stocks between successive January's, a variation that might have been less significant if estimates were made for July-June crop years, should be apparent from what has been said above, but part of it also arises from peculiarities of statistics of production and consumption that developed during the war and postwar years.

It should be remembered that flour consumption can only be measured indirectly. Any estimate must contain a certain amount of error and is not to be regarded as exact or necessarily final. Estimates made by the Department of Agriculture have been revised frequently, and there is little reason to believe that the current figures will not be changed. Some notion of the accuracy of the figures can be obtained by considering the magnitude of past revisions.[17] Chart 1 shows the various estimates of civilian flour consumption per capita for 1943 and for 1935–39 as they appeared in successive issues of the *National Food Situation* from November 1944 to December 1947. None of these estimates was "preliminary" —all were published some time after the end of the period to which they refer. It will be noticed that from April 1944 to April 1947 the estimate of consumption per capita in 1943 was revised upward three times so that the original figure of 157.2 pounds has become, as most recently published, 162.7 pounds. This is an increase of 5.5 pounds per capita, or an estimated change in total consumption of approximately 7 million sacks. Revisions in the estimate of average per capita consumption in the five-year period 1935–39 are less striking graphically, but just as significant when total consumption

[16] Civilian consumption only. U. S. Dept. Agr., Bur. Agr. Econ., *Wheat Situation* January-February 1948.

[17] Cf. G. H. Moore, "Accuracy of Government Statistics," *Harvard Business Review*, Spring 1947, XXV, 306–17.

CHART 1.—CHANGING OFFICIAL ESTIMATES OF PER CAPITA FLOUR CONSUMPTION*
(*Pounds per capita*)



* U. S. Dept. Agr., Bur. Agr. Econ., *National Food Situation*, November 1943 to October-December 1947.

is considered. The downward revision in estimated consumption per capita amounts to 1.9 pounds; this is a change in the estimate of total consumption for the period of 12 million sacks, or over 2 million sacks a year. Revisions now standing put per capita consumption in 1943 about 6 percent above the 1935–39 average. Estimates standing in May 1944 pointed to a difference of less than 2 percent.

If the revisions cited are typical, then yearly estimates may be

regarded as accurate only within 5 pounds, and the original estimate of 1943 consumption might better be written 157 ± 5 pounds. Similarly, the estimate of average consumption over the five-year period, 1935–39 may be accurate only within 2 pounds, and might be written 155 ± 2 pounds. The frequent revisions of published estimates point to the need for re-examination of the data. The differences between estimates arise largely from differences in methods used. As we have seen in previous pages, certain estimating methods introduce serious bias; we shall proceed in subsequent pages to examine some of these estimates in more detail and to present a new method of estimation which seems particularly reliable.

IV

In bringing Working's series on flour production and flour consumption up to date, it has been necessary to work out a new method for estimating production since 1935. It has also seemed advisable to eliminate from the net consumption figures all flour taken by the armed services and to calculate consumption per capita only for the civilian population.

When the *Census of Manufactures* was taken biennially (the last was in 1939) it was possible to compare production as reported monthly with the more complete reports made in the Census, but it is now eight years since even this inadequate verification[18] has been possible. On the other hand, the monthly reports have irregularly increased their coverage, so that by 1945 there were very few mills with a daily capacity of over 400 sacks not reporting monthly.[19] There is no reason to question the substantial reliability of the reported production. The problem is rather to estimate production of the mills not reporting.

For the calendar years 1940–44 the Bureau of the Census estimated total flour production from the reported production of so-called "identical" mills. These are mills covered by the Census of 1939 and also reporting every month in the year for which production is to be estimated. For each year, the Bureau of the Census assumed total production to have borne the same relationship to the production of identical mills as it did in 1939. This method of estimating total production takes improper account of the disap-

[18] Cf. tabulation, p. 521.

[19] For reasons of economy monthly milling reports from mills with daily capacity of under 400 sacks were discontinued in July 1947.

pearance of old mills and of the construction of new ones.[20] Nor does it allow for differences in the performance of identical mills and of mills outside this group; any new concerns aggressively expanding their place in the industry are necessarily omitted from an "identical" group.

In 1945 the differences in both size and rate of operation of reporting and non-reporting mills were taken into account. Because most non-reporting mills have a daily capacity of 400 sacks or less, the estimate for 1945 assumed their rate of operation to have been the same as that of reporting mills with a daily capacity of 400 sacks or less. The 1945 estimate implicitly assumed, also, that non-reporting mills made up the same percentage of total capacity of the industry in 1945 as in 1939.

In 1946 yet a third method was used, and estimated production for 1945 was revised accordingly. In the 1946 estimate the actual

TABLE 1. ESTIMATES OF UNITED STATES TOTAL WHEAT FLOUR PRODUCTION, CALENDAR YEARS, 1940–46*

(*Million cwt.*)

Year	Census estimates			Alternative estimates	
	Method I	Method II	Method III	1939 base	1935 base
1940	211.9	212.8[a]	—	211.0	210.4
1941	219.4	219.1[a]	—	216.9	216.2
1942	227.2	223.4[a]	—	220.1	219.6
1943	251.8	239.4[a]	—	236.4	235.9
1944	255.2	244.8[a]	—	242.1	241.7
1945	287.3[b]	279.4	274.4	275.1	274.7
1946	—	283.2[a]	278.9	278.4	278.0

* Census estimates as reported in U. S. Bureau of the Census, *Facts for Industry, Flour Milling Products, Calendar Year 1946*, and its predecessors. See text for description of Census and alternative methods of estimation.

[a] Approximations by the author using the method of the original Census estimate for 1945.

[b] Approximation by the author made in the same manner as Census estimates for earlier years, but assuming that identical mills accounted for the same percent of total production in 1945 as they did in 1941 (instead of 1939).

number of active mills not reporting monthly was computed on the basis of various records, and to each such mill was attributed the average production rate of reporting mills of similar size, less an allowance for the fact that non-reporting mills tend to operate at a lower rate than do reporting mills. (A check of actual production

[20] See *Northwestern Miller*, Apr. 25, 1945, p. 10.

of 130 mills added to the survey during 1946 showed their rate of operation was but 58 percent of mills of similar size reporting every month in 1946.) To this was added an estimate of production of very small mills not included on any mill lists.

Estimates of total flour production by each of the foregoing methods are shown in Table 1. Published estimates of production were based on the first method for the calendar years 1940–44, and on the second method for 1945. If Method II, which was used only for 1945, had been applied in 1943 and 1944, total estimated annual production would have been as much as 12 million sacks less than the published figures. Apparently Method III would have given an even smaller estimate.

I have estimated the amount of unreported flour production for each year 1940–46 in a manner that seems to make total flour production estimates consistent with production as estimated for years prior to 1940, as well as with production reported in the Censuses of Manufactures. For 1945 my estimate is about 300,000 sacks above the Census Bureau's, while for other years it is considerably lower. Estimates were made by assuming that (1) production of the average non-reporting mill varied directly with the rate of operation of reporting mills with a daily capacity of less than 400 sacks, and that (2) the number of non-reporting mills varied directly as did the difference between the total number of mills on the *Northwestern Miller's* annual list and the number of reporting mills. Thus,

if U_i = unreported flour production in year i
U_c = known unreported flour production in census year
r_i = rate of operation in year i of reporting mills with daily capacity of 400 sacks or less
NWM_i = number of mills in year i as reported by the *Northwestern Miller*

and

C_i = average number of mills reporting monthly to the Bureau of the Census in year i

then

$$U_i = U_c \times \frac{r_i}{r_c} \times \frac{NWM_i - C_i}{NWM_c - C_c}.$$

Two estimates of production were made—one based on the Census of Manufactures taken in 1939, the other on that taken in

1935. The two series appear in the two final columns of Table 1. The 1939 Census appeared to be the obvious choice because of its recency, but because the 1935 Census has been corrected on the basis of a special tabulation to remove the error caused by irregular reporting periods[21] and the 1937 and 1939 censuses have not, it seemed advisable to depend upon the earlier year. In production estimates based on 1935 I have used the revised 1935 production figure, plus an allowance of 1 million sacks for production not reported either in the census or in the monthly reports.[22] The production estimates based on 1939, on the other hand, use the census figures without any revision.

Estimates based on the 1935 Census and on the 1939 Census, as shown in Table 1, differ throughout by less than 700,000 sacks. But because of the greater reliability of the 1935 base, the series derived from it has been used to estimate consumption.

One virtue of this estimate of flour production is its simplicity. More important is the fact that it avoids known sources of bias in other methods. Lacking any information about the true relationship between all the variables affecting unreported production—and there are many more than those taken into account in the estimate—one may assume that the best and least misleading estimate can be made by taking all relationships as linear.[23] Furthermore, only those variables which appear to be of first importance are recognized. The annual list of mills compiled by the *Northwestern Miller* has achieved completeness and consistency over the years sufficient to make it a reasonably reliable index of number of mills.

The assumption equating the rate of operation of all non-reporting mills to the operations of reporting small mills may seem at first somewhat tenuous, but there are good reasons for accepting it. The Bureau of the Census has achieved almost 100 percent coverage in its monthly report of mills with capacity of over 400 sacks daily. It is reasonable to assume that the operations of small mills are affected by similar conditions whether reporting or non-reporting. There is evidence to support this assumption. Of 1,671 small mills included in the *Northwestern Miller's* list of mills in

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[21] See above, p. 5.

[22] Working, *Wheat Milled and Flour Production in the United States, 1931 to 1937.*

[23] It is assumed that changes in total output of non-reporting mills are directly proportionate to changes in their number and in the rate of operation of reporting small mills.

1945, 1,273 were located in 12 states. In these same states were to be found 454 of the 608 small mills reporting monthly to the Bureau of the Census. If local conditions are most important in determining the rate of operation of small mills, as seems likely, then non-reporting and reporting mills must have been subjected to similar influences. As a matter of fact, in 1942 and 1943 wheat production in the 12 states containing most of the small mills ranged 25–40 percent below that of 1939–41, while total national production of wheat ranged 10–15 percent above that of 1939–41. This may be one reason why the small mills failed to share in the increased utilization of capacity achieved by most large mills.

American imports and exports of flour are reported by the Bureau of the Census. Census Bureau figures are obtained from customs documents and presumably are reliable except as to timing (i.e., some June exports may be reported in July, etc.). Unfortunately, however, they do not include all wartime flour movements in and out of the country, particularly military shipments for civilian relief abroad. It is necessary to combine the foreign trade figures of the Department of Commerce with estimates of shipments not included in customs reports. Such estimates are made by the Department of Agriculture.[24]

During the war another kind of export, appearing in none of the official figures, must be considered. An undetermined amount of flour was supplied by the Army and Navy from stocks built up for their own use, to be used by allied troops and by native employees and for distressed civilians in occupied territories. No record of the amount of flour that was thus removed from American consumption is available, nor is there any record of how much flour "loaned" in this fashion was returned.

This "leakage" of flour out of the United States constituted the strongest argument for excluding all military takings from the consumption estimate. Another reason for concentrating on civilian consumption only is the fact that military stocks cannot be expected to vary as do civilian stocks. In preparation for overseas campaigns the military authorities built up extraordinary reserves, even of such readily available commodities as flour, and such stock-building could easily affect estimates of flour consumption. Sta-

[24] Imports and exports reported by the Department of Commerce may be most easily obtained from the Department of Agriculture's *Foreign Agricultural Trade*, other shipments are reported from time to time in *Wheat Situation*.

tistics of military stocks of flour during the war have not yet been made available, but there is some information on the relative level of stocks to consumption. According to a War Department Press Release of April 4, 1945, the Army tried to maintain the following reserves of non-perishable foods in 1943 and 1945:[25]

Location	Number of days' supplies	
	1st half 1943	1st quarter 1945
For troops in United States		
At Army depots and camps	90	75
For troops overseas		
At United States depots and ports	68	60
At overseas depots and ports	108	70

To reserves for troops overseas should be added an allowance for goods in transit amounting to about 70 days.[26] Estimates of total flour required to build military reserves are shown in Table 2.

The final step in estimating consumption is to relate it to net disappearance.[27] It seems apparent that if the flour taken by the military can be isolated in some way from flour available for the civilian population, an estimate of per capita civilian consumption more nearly comparable to peacetime measures can be made. If the supplies going to military consumption are eliminated from estimates of total disappearance, it is possible to avoid errors introduced into the computations by leakages of military stocks to foreign consumers, sharp changes in stocks resulting from military stockpiling, and extraordinary losses of flour resulting from wartime

[25] As quoted by Sidney Hoos, "The Determination of Military Subsistence Requirements," this JOURNAL, November 1946, XXVIII, 979.

[26] See E. B. Gregory, "Army Does Not Hoard Food," *Northwestern Miller*, July 7, 1943, pp. 42 ff. Estimate of time in transit is the difference between total figures reported by Gregory, less allowance for losses less stocks reported by Hoos.

[27] Consumption as measured here is not a specific measure of net ingestion. It may be regarded as an index of ingestion only so long as the progress of flour from mill to ingestion is unchanged from year to year. If the distributing mechanism is altered so as to increase the loss between milling and eating, the index will not move parallel to ingestion. Wartime regulation of bakers, for example, may result in a reduction in the amount of stale bread diverted from human to animal consumption and, similarly, postwar shortage and government exhortation may somewhat reduce the amount of table waste. More important, however, than such reductions in waste are losses incident to military operations. Estimates of flour losses in transit to overseas destinations during the war run from 10 to 15 percent, including losses from enemy action and spoilage resulting from faulty handling and from unusual climatic and storage conditions. Estimates of the magnitude of these losses are shown in Table 2.

conditions. Then, with a consistent estimate of total flour production, it should be possible to obtain a fairly reliable estimate of civilian consumption of flour under wartime conditions.

It will be found, however, that even when flour going into military supplies is eliminated from the total of flour available, not all

TABLE 2. UNITED STATES MILITARY REQUIREMENTS OF WHEAT FLOUR AT 154 POUNDS PER MAN PER YEAR, 1940–41 THROUGH 1945–46*
(*Thousand cwt., except as noted*)

Item	1940–41	1941–42	1942–43	1943–44	1944–45	1945–46
For men in the United States eating military supplies						
Number[a]	590	1,618	4,020	4,796	3,430	2,454
Consumption	909	2,492	6,191	7,386	5,282	3,779
Stocks	484	896	2,002	1,579	1,041	485
For men overseas						
Number[a]	78	392	1,658	3,910	6,866	4,000
Consumption	120	604	2,553	6,021	10,574	6,160
Stocks	—	926	2,615	5,715	6,351	1,121
Total military requirements						
Consumption	1,029	3,096	8,744	13,407	15,856	9,939
Stocks	484	1,822	4,617	7,294	7,392	1,606
Change in stocks	+ 484	+1,338	+ 2,795	+ 2,677	+ 98	−5,786
Lost in transport	13	170	471	1,013	1,246	0
Total requirements	1,526	4,604	12,010	17,097	17,200	4,153
Military takings	—[b]	2,510	13,666	18,029	23,000	4,000
Difference	—[b]	−2,094	+ 1,656	+ 932	+ 5,800	− 153

* For sources and methods of computation see text. Number of men eating military supplies in the United States and overseas derived from Census Bureau and U. S. Department of Agriculture estimates. Military takings (overseas not shown separately) are unpublished estimates supplied by the Bureau of Agricultural Economics as the best currently available, although still to be regarded as preliminary.

[a] Average number of men in thousands.

[b] Not available.

of the influence of wartime conditions on the organization of the trade will have been eliminated. Flour stocks in the distributing system must inevitably be influenced by the large flow channeled into military use, with consequent possible variations in the amount of stocks in the civilian system. Isolation of military consumption from civilian consumption is sometimes objected to on the grounds that the part of the population that went into military service is typically one with a higher than average per capita flour consump-

tion, and that therefor per capita consumption figures for the remaining civilian population are not properly to be compared with per capita consumption figures for the entire population before the war. Examination of the evidence on military consumption, however, shows that per capita consumption of flour by military personnel is probably no higher, and may be lower, than that for the population as a whole. Even if this were not true, the number of men that were in the armed forces was a relatively small part of the total population, and its removal would have little effect on total per capita consumption.

Although Army allowances of flour per man at 180 pounds per year are one-sixth higher than the 154-pound civilian average, the allowance is probably larger than the amount actually taken. According to Hoos,[28] "a sample study based on some forty Army ground and air force stations . . . " revealed that actual issues of grains and cereals were but 77 percent of prescribed issues. Paul E. Howe reports similar results from 117 surveys of Army consumption of bread and cereals made in 1942.[29] With prescribed rations about 180 pounds per capita, these studies indicate a military consumption per capita of only about 140 pounds. Part of the difference between prescribed rations and actual consumption may arise because the surveys measure consumption at a point closer to ingestion than does the ration allowance, but most of it must reflect an upward bias of the ration allowance.

Table 2 compares the number of rations required for the armed forces, including an allowance for stock-piling and losses, with reported military purchases. The views of Hoos and Howe are broadly confirmed; there is no clear evidence here of consumption at a rate in excess of 154 pounds, especially if the assumed stock increase of 1.3 million sacks in 1941–42 did not take place until 1942–43. Diversion of military supplies to allied forces and for civilian relief might well account for the excess of purchases over requirements. The deficit in 1945–46 may represent repayment to the Army of flour that it loaned earlier. My estimates of total military requirements are probably a closer approximation to the amount of flour actually used by the military than is the estimate of military takings, but it is the amount actually removed from the

[28] Sidney Hoos, *op. cit.*, pp. 976–77. The study was apparently made in the winter and spring of 1943–44.

[29] P. E. Howe, "The Dietaries of Our Military Forces," *Annals of the American Academy of Political and Social Science*, January 1943, CCXXV, 72–79.

civilian supply, for whatever purpose, that is pertinent in an investigation of civilian consumption. Military takings, therefore, rather than an estimate of military consumption, are subtracted from the civilian supply in order to obtain net civilian retention.

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Estimates of net civilian retention, derived by deducting from estimated production net exports, shipments outside the United States, and all military takings, are shown in Table 3. Per capita

TABLE 3. UNITED STATES TOTAL WHEAT FLOUR PRODUCTION AND CIVILIAN NET RETENTION, 1935–36 TO 1946–47*

(*Million cwt., except as noted*)

Year July-June	Production			Net Exports[b]	Military Takings	Civilian net Retention[a]	
	Reported	Unreported	Total			Total	Per capita (*pounds*)
1935–36	192.9	11.9	204.8	7.6	—	197.2	154.4
1936–37	196.5	11.1	207.6	8.8	—	198.8	154.7
1937–38	197.9	10.2	208.1	11.1	—	197.1	152.3
1938–39	205.1	10.6	215.7	14.1	—	201.6	154.6
1939–40	204.7	9.8	214.5	14.0	—	200.5	152.4
1940–41	206.4	8.6	215.0	13.7	—	201.3	151.8
1941–42	205.5	7.5	212.9	11.5	2.5	198.9	151.0
1942–43	224.6	6.6	231.2	14.4	13.7	203.1	156.5
1943–44	234.8	5.8	240.6	24.2	18.0	198.3	154.4
1944–45	252.6	5.1	257.7	36.8	23.0	197.8	154.0
1945–46	264.0	4.7	268.8	58.0	4.0	206.8	154.5
1946–47	300.2	5.1	305.3	89.9	1.0	214.4	152.6

* Reported production from successive issues of U. S. Bureau of the Census, *Facts for Industry, Flour Milling Products*, and its predecessors. Unreported production estimated by the author (see text for methods). Net exports from U. S. Bureau of the Census, *Monthly Summary of Foreign Commerce*, and U. S. Dept. Agr., Bur. Agr. Econ., *Wheat Situation*. Military takings (overseas not shown separately) are unpublished estimates supplied by the Bureau of Agricultural Economics as the best currently available, although still to be regarded as preliminary. Population January 1 from Census Bureau through 1940–41; for later years average population eating out of civilian supplies based on data in U. S. Dept. Agr., Bur. Agr. Econ., *National Food Situation*, October–December 1947, p. 32, but without adjustment for under-enumeration of children. Details will not necessarily add to totals shown because of rounding.

[a] Includes military supplies prior to July 1, 1941.

[b] Includes flour milled from domestic and from imported wheat, shipments to possessions, and military shipments for civilian relief abroad.

civilian retention estimated in this fashion is considerably below the estimates published in the *National Food Situation* for the war

years, and is little different from total per capita retention for the ten-year period preceding.

The newly estimated net retention figures appear to be more reliable than those published heretofore. The assumptions on which flour production has been computed are simple, and they are in agreement with available knowledge of the industry. Furthermore, the net retention figures are largely free from aberrations due to military consumption and disposition of flour.

It is not to be assumed that the new estimates are free from all error. The good agreement between my estimates of production for the calendar years 1945 and 1946 and those of the Bureau of the Census seems to indicate that the error here is not large, but even so it may be as much as 1 million sacks. The military takings figures are only approximate and, although they appear reasonable, there is no way of estimating their error. Furthermore, when computing net civilian retention, no allowance has been made for changes in stocks between successive July's. How can such estimates of retention be used to estimate total civilian consumption?

As a first approximation we may look for evidence of change in the rate of civilian consumption, disregarding for the moment the question of amount and considering only the direction. Let us set up the hypothesis that civilian consumption was constant from 1935 to 1945 at the average level for that period, and see if the changes in civilian stocks necessary to reconcile this hypothesis with the new estimate of net retention are reasonable.[30] The resulting figures are shown in Table 4.

This calculation suggests a reduction of 3.3 million sacks in civilian stocks during 1941–42, perhaps resulting from active entry of the United States into the war, and their restoration in 1942–43. It is reasonable to suppose that stocks were low in July 1942. There had been a previous downward trend in flour prices such as commonly discourages holding of flour stocks, and prospects of an OPA ceiling on flour prices (which came in October 1942) seemed to give

[30] In discussion of the possible errors in estimates of per capita consumption, I have throughout neglected mention of errors in population estimates, since they are usually so small as to be disregarded, and it is customary to use the official estimate for January 1. During the war the number of persons eating out of civilian supplies, the magnitude appropriate here, changed very rapidly during some 12-month periods. Estimates are available only for January 1 and July 1, and it was necessary, therefore, to average the estimate for initial, terminal, and mid-point dates, weighting the mid-value double, to obtain an approximation of the *average* number eating civilian supplies during the year.

TABLE 4. UNITED STATES CIVILIAN CONSUMPTION AND APPARENT RETENTION OF WHEAT FLOUR, WITH CHANGES IN STOCKS, 1922–23 TO 1946–47*

(*Million cwt., except as noted*)

Year July-June	Estimated consumption		Net retention	Change in stocks	
	Per capita (*pounds*)	Total		Annual	Cumulative
1922–23	176	196.0	195.3	− .7	− .7
1923–24	176	199.7	199.1	− .6	−1.3
1924–25	176	203.1	201.9	−1.2	−2.5
1925–26	176	206.0	207.1	+1.1	−1.4
1926–27	176	208.7	211.7	+3.0	+1.6
1927–28	176	211.5	209.7	−1.8	− .2
1928–29	176	213.6	214.1	+ .5	+ .3
1929–30	172	211.3	211.1	− .2	+ .1
1930–31	167	206.0	204.4	−1.6	−1.5
1931–32	162	201.5	203.2	+1.7	+ .2
1932–33	159	198.9	206.8	+7.9	+8.1
1933–34	154	194.0	188.0	−6.0	+2.1
1934–35	154	196.0	193.5	−2.5	− .4
1935–36	153.5[a]	196.0	197.2	+1.2	+ .8
1936–37	153.5[a]	197.2	198.8	+1.6	+2.4
1937–38	153.5[a]	198.6	197.1	−1.5	+ .9
1938–39	153.5[a]	200.2	201.6	+1.4	+2.3
1939–40	153.5[a]	201.9	200.5	−1.4	+ .9
1940–41	153.5[a]	203.5	201.3	−2.2	−1.3
1941–42	153.5[a]	202.2	198.9	−3.3	−4.6
1942–43	153.5[a]	199.2	203.1	+3.9	− .7
1943–44	153.5[a]	197.2	198.3	+1.1	+ .4
1944–45	153.5[a]	197.2	197.8	+ .6	+1.0
1945–46	153.5[a]	205.4	206.8	+1.4	+2.4
1946–47	153.5[a]	215.7	214.4	−1.4	+1.0

* Holbrook Working's estimated consumption and computed retention through 1934–35 from *Wheat Studies of the Food Research Institute*, December 1936, XIII, 225, and *ibid.*, December 1937, XIV, 175. From 1935–36 per capita estimated consumption is arbitrarily set at the 1935–46 average per capita computed net retention (rounded). Total estimated consumption from 1935–36 equals per capita consumption times January 1 population through 1940–41; for later years, times estimated average population eating out of civilian supplies described in Table 3. Computed net retention from Table 3. Change in stocks taken as the difference between estimated consumption and computed net retention.

[a] Not accurate to one-tenth pound but probably within one pound. See text, pp. 20–22.

assurance against a large price advance. Monthly disappearance and reports on flour sales during April-June both indicate that commercial flour stocks were being reduced considerably more than is usual at that season. Such changes of stocks, amounting to about 2 percent of the total production, are not of an unprecedented magnitude. Even when military and civilian stock changes for these years are pooled, the change is less than 3 percent of the year's

production—less than 11 days' production.[31] These are certainly not to be considered violent changes in stocks during the period of preparation for and active prosecution of a great war. They do not seem great enough to force us to reject the hypothesis that per capita consumption remained unchanged.

This is not to say that we have demonstrated that there was no change whatever. It is possible that civilian consumption per capita fell by, say, 1 percent in 1941–42, only to rise by about 2 percent in 1942–43, and decline slightly thereafter. The data are no more inconsistent with this hypothesis than with that of no change. But there is no evidence forcing us to assume such changes. With one part of the flour disposition unknown—the actual change in stocks—our estimates are not sufficiently accurate to uncover a wartime or postwar fluctuation as small as 1 percent. I am inclined to believe that a variation in per capita consumption as great as 2 percent would leave in the statistics more positive evidence of change than appears anywhere after 1932–33.

The safest conclusion to draw from the data is that there was no demonstrable change in the rate of civilian flour consumption in the United States during and after World War II, at least through June 1947. This is a surprising result. Removal from the population of 10 million men in the vigor of youth, a great increase in the level of industrial activity, a sharp rise in per capita income available for food, wartime disturbance of the distribution of goods—all these have effected no discernible change in the course of flour consumption. It is possible that the impact of World War II will yet result in alteration of American flour consumption; but through the 1946–47 crop year there was no good evidence of change from the level that prevailed during previous years.

[31] Part of the apparent deficit in military stocks in 1941–42 must have been made up by reverse lend-lease supplies from Australia. Information as to the amount of flour supplied in this fashion is not available.

AGRICULTURE AND HISTORY*

RODNEY C. LOEHR
University of Minnesota

THE recognition of agricultural history as a separate field of labor for the historian has come only during the past century. It is curious to note that although the great majority of mankind throughout recorded history have been farmers, not until recent years have historians studied the history of agriculture. Horsemen riding over the rim of the world in search of plunder and conquest, nations rising to power and then dropping back in the parade as new leaders emerged, the labored efforts mankind has made in learning how to live together, the pageantry of courts, the lives of the great—all these have gained the attention of the historian and have been recorded for the edification of posterity. But the story of the husbandman among his flocks or in his fields has had to wait until recent times to find its tellers.

The metes and bounds of agricultural history are not yet clearly defined, for like other divisions in the story of the past, the history of agriculture merges insensibly into the totality of human experience. This difficulty of exact delimitation of an area of study is common to the arts and sciences. The important thing is that the history of agriculture as a distinct field of study is now recognized as worthy of the attention of the historian.

Oddly enough, agricultural history in the English-speaking world appeared as a by-product of other studies. In the nineteenth century legal historians in England were attempting the study of the development of the forms of property holding in the medieval world, particularly the study of the evolution of land tenure. Although undertaken primarily as legal studies, the works of Seebohm and Vinogradoff throw considerable light on the agriculture of medieval England. It was probably fortunate for succeeding generations of agricultural historians that the early writings in agricultural history were made by legal historians, since their studies described the legal framework within which the agricultural society functioned. A society's laws consist of the established rules of conduct which experience and custom have shown to be useful for

* A paper presented at the annual meeting of the American Farm Economic Association, Green Lake, Wisconsin, September 10, 1947.

the perpetuation and well-being of the individuals within the society. Laws relating to agriculture are of interest for their descriptions of practices within the agricultural world.

These studies by English legal historians have been useful to students of agricultural history on several counts. They described agricultural practices that time had shown to be generally suitable for the circumstances and applicable over relatively wide areas in England. In the second place, it is within this English legal framework, transposed to and modified by the American environment, that our American farmers operate.

To the legal studies, others dealing with English agricultural labor were added. Gradually English and American historians began to poke and pry into many different phases of agricultural history. By the time of World War I agricultural history was recognized as a separate and respectable field of study for historians some of whom were interested primarily in the history of agriculture for itself and not solely for the light which it might throw on other subjects. The American agricultural historian however, faced some knotty problems, for by this time American agriculture covered a continent and had three centuries of history behind it.

The term "agricultural history" is a broad one. It covers the multitude of factors which shape and affect the lives of people who earn their living by the cultivation of the soil. The American scene is a broad panorama whose immense sweeps of color and variety of detail are beyond the strokes of any one historian. The canvas stretches from the rolling wheat lands of eastern Washington to the tobacco plantations of the Carolinas and from the olive groves of California to the dairy farms of Vermont. The variety in American agriculture is bewildering, and the differences between the agriculture of the regions of the United States sometimes seem greater than the similarities. If one were looking for a representative figure, "the American Farmer," one would certainly look in vain.

From the very beginning of our history this variety in agricultural pursuits appears. What common bond was there, for example, between the eighteenth century Virginia tobacco planter and the Rhode Island cheesemaker? Was the nineteenth century American farmer an Alabama cotton planter or a Minnesota wheat grower? Can there be a history of American agriculture, or should it be histories of American agricultures? In the face of these difficulties what can the agricultural historian contribute in aid to the farm

economist? Out of the variety of activities and experiences of the American farmers what is there that may be of use to the economists?

Let us begin by examining the forms of land tenure. The American ideal, I suppose, is the yoeman farmer, a sturdy individualist who is the freehold owner of a relatively large number of acres of land which he farms according to his pleasure. Freehold ownership, however, has not always been the form in which American land has been held. In colonial times and even in the early national period quit-rents were not unknown. Today, tenancy is common, and the owner-operator, free of financial obligations other than taxes, frequently attains that position only after years of struggle.

Why has the American ideal been so difficult to reach? American land traditionally has been cheap land. It was not so long ago that a generous government gave away an enormous amount of the public domain, and yet today many farmers either do not have a clear title to the land they farm or operate as tenants. Historically speaking, a number of factors have intervened between the ideal and its achievement. A gift of 160 acres of raw land did not make a farm. The land had to be cleared and broken. It took time to discover the capabilities of the soil. Supplies, food, seeds, animals, tools, machinery, equipment, homes, barns, and fences, all were necessary to the successful operation of a farm and were not furnished by a wise and beneficent government. One way to get these capital requirements was to mortgage the farm. Then, long years of labor might follow before the land was cleared of financial, as well as material, encumbrances.

Moreover, the task of turning a wilderness into a settled community was not solely a matter of creating farms. Roads, schools, courthouses, jails, churches and other community conveniences had to be built. All of this meant that for a considerable period of time most of the energies of a new community went into the creation of fixed capital over which there was incomplete ownership by the occupiers. It also meant that the level of living was relatively low during the period of capital building.

Let us take another example of a divergence from the American ideal of freehold ownership. Prior to the Civil War much of Southern society was organized on the basis of working the land with slave labor. After the war Southern society was faced with a problem that was grave, immediate, and practical. How could the freed

negroes, who usually possessed no capital and who had had no experience in self-direction, be joined to the land to produce the Southern staples? The land was not free; it could not be given to the negroes, in spite of their dreams of 40 acres and a mule. The answer to the problem was the share-cropping system under which the negro supplied the labor, and the landlord supplied land, capital requirements and a certain amount of direction. The solution did not produce yeoman farmers, but it did produce cotton.

In the past we have taken pride in the belief that the landless agricultural laborer, who had little hope of ever becoming a landowner, was an Old World phenomenon. This relic of the feudal system could never appear in a brave New World where to the westward "the land was bright." In the colonial era, it was true, there had been indentured servants, but in time they could become land-owners and even reach the eminence of signing the Declaration of Independence. We did have the hired man and the hired girl, but they were usually treated as part of the family, since they frequently were neighbors' children who in time would take their places as yeoman farmers. Then, there were the harvest hands, but these migratory workers disappeared with the passing of the season and were seen no more until the next harvest. The landless agricultural laborer, living in a cottage attached to an estate, would never be a part of the American landscape. The family farm unit was not only the American ideal; it was also the most efficient from the standpoint of size. There was no need for the attached cottager.

Can we be so sure that the landless agricultural laborer will not appear in America, in spite of the geographical and ideological distances separating us from a feudal Old World? What will be the effects of corporation farming? Will not the increasing use of farm machinery enlarge the size and cost of the farm unit, thereby widening the distance between the rungs on the agricultural ladder? What will be the effects of another agricultural depression? May we not yet see the emergence of a class of landless agricultural laborers?

I should now like to comment briefly on several other phases of agriculture. Agricultural improvements, such as improved seeds, livestock, tools, machinery, rotation of crops, fences, barns and the like certainly must be of interest to the farm economist, since they bear directly on the productivity of land and labor. The agricultural historian can report on the introduction of these improve-

ments, something about their extent, their replacement and the reaction to them, but he cannot give complete statistical data on these matters. Complete records do not exist and recognized measuring sticks have not been set up. The reaping machine, for example, obviously saved labor and made the harvest work easier, but it is impossible to say how much labor was saved for several reasons. The old method of reaping had been to use a cradle scythe. The amount of grain which a cradler could cut in a day depended upon his strength, endurance and skill, as well as on the condition and kind of the grain, the lay of the land and the weather. Under these circumstances it is difficult to establish average figures for the amount of grain a cradler could reap in a day. On the other hand, reaping machines also varied in the cutting of grain. The machines were constantly improved, so that measurements in the first place depend upon the machine selected. Even beyond that considerable variation occurred, depending again upon the condition and kind of the grain, the lay of the land, the weather and the skill of the operator. The best that can be done, I suspect, is to take the reports of the times concerning average and good cutting figures for both cradles and machines and present them for what they are worth. This does not mean that such information is without value, but it does mean that figures regarding increased productivity as the result of the introduction of farm machinery, must be regarded as approximations and as invalid for general application.

Let me use another example: the improvement of livestock. "Improvement" here is a relative term. It depends upon the values which the improver wishes to establish, whether these be longhorns, greater strength, better beef or an increased milk supply. Some of the improvements can be, and in recent years, have been measured, but the available figures cover only a relatively short period of time. In the case of milk production I doubt if consistant figures go back much more than a century. One can get occasional milk production figures for the 18th century or even earlier, but the reliability of these figures is open to question.

As far as improvements in agriculture are concerned, then, the historical method of approach is largely descriptive. It certainly cannot deal in absolutes, and it cannot give complete answers. The reason is that past generations kept their records to answer their own questions and not ours. This does not mean that the historian's labors are wholly useless, for a little information is better than none.

Markets and transportation have been of vital importance to the farmer. The wholly self-sufficient farm probably never existed in this country, since even the frontiersman in fringed deerskins and coonskin cap needed powder, shot, iron, and salt. The pioneer farmer on the farthest frontier, then, had to create a surplus which could be exchanged for articles he could not supply. The creation of this surplus during the first few years of the pioneering process was a laborious task. The land had to be cleared and broken up, and little energy was left for the production of a surplus beyond the pioneer's needs. What surplus there was might be collected by peddlers whose exchange goods were carried on their backs or on pack-horses. Trade was small, and a peddler might not do more than a dollar's worth of business in a day's time. Along the navigable rivers the farmer's problem was easier. He could take his produce to a distant market by boat or raft, or a store-boat collected and exchanged his surplus for needed supplies.

With the passage of time the general store appeared, and village markets were established. The farmer had shorter distances to go to reach his outlets to the outside world. Unlike the peddler or the storeboat, the sedentary merchant in the general store was always available. The variety and cheapness of goods available for exchange increased, and, as a result, the farmer could specialize and use his resources more efficiently. He no longer had to be a jack-of-all-trades, and as the neighboring village increased in complexity he gained increasing benefits from the finer divisions of labor involved.

Not all of the effects of an increased dependence on a market were beneficial to the farmer. He became more subject than ever before to the violence of the economic storms that occasionally blew, particularly if he had specialized his labors to the extent of a one-crop economy. Sometimes he suspected that the middlemen, who seemed to control the market place, had firm control of his income and out-go. On the whole, however, the rapid development of markets has contributed greatly to the well-being of the American farmer.

Ease of access, of course, is one of the characteristics of a good market. Just as important is ease of transportation to the market. In my opinion, transportation is the most vital factor in any modern economy. If transportation breaks down, the exchange of goods and services slows down. Production shudders to a halt,

since raw materials become unavailable and finished goods pile up.

Settlement itself is limited by the availability of transportation. This can be demonstrated historically. At first, settlement clung to the rivers, the natural highways of a continent. Then, minor road systems were developed, and settlement could push away from the rivers. But when tongues of settlement thrust through the Appalachian barrier, the transportation problem of getting goods to and from markets became very difficult. The river systems west of the Appalachians led to the Gulf of Mexico, thousands of miles from the market and supply centers of the East. Heavy, bulky, cheap agricultural commodities, such as grains, could not stand the overland transportation charges to the East. Only commodities which could transport themselves, such as livestock, or products with a high value for small bulk, such as whiskey, could be sent to Eastern markets. The natural outlet for the rest was down the river systems to the South. But the Southern outlet, New Orleans, was limited in size, had a climate that made preservation of farm produce somewhat difficult, and was in Spanish hands. Fortunately the settlers' predicament was resolved in time by the building of national roads over the mountains, the invention of steamboats which could run upstream against the current, the digging of canals to the Great Lakes, and the laying of railroads.

Of all of the forms of transportation, the railroad was the most important to the farmer. He was no longer dependent on the seasons for the shipment of his produce, since the railroads, unlike water transport, were all-weather highways, The railroads easily ran over the prairies, away from the streams, and carried settlement with them. The conquest of the frontier and the spread of settlement was greatly speeded up. In spite of the farmers' grievances against certain railroad practices, it would seem reasonable to suggest that railroads provided cheaper and surer transportation than had previously been available for many areas and that this cheap transportation did raise the prices received by the farmer for his produce and lower the cost of his purchases. On the other hand, the railroads did enlarge the area of competition in which the farmer strove.

The preceding remarks are not offered as a complete account of the agricultural historian's labors nor of what he may contribute to the understanding of the farm economist. This slight examination

of a few of the facets of the agricultural story may illustrate some of the difficulties which the historian faces and the limits on his contributions. It may also show that it is possible to give a historical explanation for the existence of a situation. The historian cannot always give a complete nor a wholly satisfying explanation, since he is limited by the availability of records. In the face of the myriad activities of mankind the historian, I hope, has learned to approach with humility the study of a complex area of history and to avoid an arrogance based on the possession of a little knowledge.

THE OBJECTIVES AND METHODS OF AGRICULTURAL ECONOMICS*

BUSHROD W. ALLIN
Bureau of Agricultural Economics

THE history of agricultural economics and the economic history of agriculture are two very different though closely related subjects. The first is an account of the changing ideas, objectives and methods of agricultural economists, as revealed in such publications as the JOURNAL OF FARM ECONOMICS; the second is an analytical, descriptive and statistical account of the changing economic status of farm people and of the methods by which they have delt with the problem of making a living. The first is a record of "theory" or mental tools useful for improving the levels of living of farm people; the second is an indispensable part of the subject matter needed by economists in developing useful theory. The essential inseparability of the contributions of both economists and historians in dealing with the economic problems of agriculture is the occasion for this round table.

The early history of agricultural economics in this country is replete with discussions of scope and objectives. For example, there was the "line fence" conception, or the notion that the field of agricultural economics should be restricted to those things which could be acted upon by the individual farmer within his own line fence. The prevalence of this idea at the time the American Farm Economic Association and the JOURNAL OF FARM ECONOMICS were founded is the reason for the word "farm" in both titles. Tradition has kept it there.

The "line fence" or individual farm management schools were dominant in the early days simply because they were the product of Land-Grant Colleges dedicated to the improvement of individual farm management. These colleges had already made long strides in developing the separate sciences of farm technology such as soils, agronomy, and animal husbandry. What they felt the need of first in the field of economics was integration and synthesis of the findings of physical science in their application to the individual farm, assuming the institutional or social situation as given.

But along with this development, another branch of the agricul-

* A paper presented at the annual meeting of the American Farm Economic Association, Green Lake, Wisconsin, September 10, 1947.

tural economics profession was growing under the leadership of Professor Ely, who still earlier had been a student of Karl Knies of the German Historical School. This branch recognized the importance of the economics of individual farm management, but it was also concerned with institutions, or the collective actions of governmental, economic and cultural organizations as they affected the economic well-being of the individual farmer—something the individual farmer acting alone could do nothing about, but which he could affect as a participant in voluntary associations such as general farm organizations, cooperative marketing associations, and political parties. This branch has come into full flower in its concern with public agricultural policy." It has even blossomed to the point where some farm leaders have been asking whether the purpose of agricultural economics is to improve the well-being of the farmers or that of the "public." This could happen, of course, only because ours is a democratic economy in which group interests are compromised by collective bargaining—not one in which the general welfare is served either as a "natural" consequence of "atomistic competition" or by the edicts of an all-wise and all-powerful dictator. In fact, old "General Welfare" himself is only an abstraction without any "troops" or organization behind him to make his will effective. And the agricultural economist who would work to improve the well-being of farmers in a manner consistent with the general welfare must have an understanding of diplomacy as well as of economics.

In any event, the increasing emphasis upon the institutional aspects of agricultural economics has the greatest significance for this round-table, because all institutions have *historical roots* a knowledge of which is essential if they are to be understood—and if on the basis of such understanding they are to be modified intelligently to meet changing conditions.

Methods in agricultural economics have changed with the changing problems. Cost analysis for individual farms with a view to discovering the relative importance of limiting and complementary factors in the determination of profits is still important for that purpose. But we are now concerned also with "regional adjustments in production," and "production goals" from a national point of view. This type of information is needed in the production planning of Federal "action" agencies. Research in land economics has evolved through a descriptive type aimed at showing the amount

and location of agricultural resources and production to the development of "directional measures" useful to various "levels" of Government and to cooperative groups as a means of dealing with the "public" problems of land utilization. Statistical research, originally concerned mainly with the construction of index numbers to help guide the individual farmer, now includes a great deal of what has come to be known as "service work," which is work designed to answer questions of public officials and administrators engaged in carrying out and amending public agricultural programs. The "master sample" and the "enumerative survey" are supplementing traditional crop and livestock reporting because more and better statistical information is needed by Government. And public opinion or attitude studies are important aids in determining and administering public agricultural policy. Soil conservation has become a public as well as an individual responsibility, and research has not yet caught up with this veritable revolution.

Investigations in the field of farm population and rural welfare have expanded from community studies to inquiries into the characteristics and distribution of the national farm labor force, from studies of local government to those of social security and of all manner of public facilities and services. Research in marketing has grown from studies of marketing practices and problems incident to the administration of regulatory measures until they include such matters as the economic significance of food stamp plans. Studies of foreign trade in agricultural products have evolved from analyses of the economic importance to farmers of imports and exports to food economics on a world-wide scale, as revealed by such activities as those of the Food and Agriculture Organization and the International Emergency Food Council. Here, agricultural economics becomes a part of social science in the broadest sense.

If the purpose of social science is to yield "understanding" of social or human relations, one of the methods by which such understanding must be achieved is to search out the interconnections between the contributions of the various social disciplines. The relation of jurisprudence to agricultural economics is apparent in the history of the Agricultural Adjustment Act. And every "school of thought" or system or logic in economics rests on a conception of human nature. Classical doctrine rested on the assumption that "man's self-interest is God's Providence." Others have denied this and rooted their views in "pragmatism." All of which is background

for one of the main points I want to make in this paper, namely, that academic training in all the social disciplines, including agricultural economics and history, is over-specialized. This is one aspect of the problem of method, and a very important one.

I think all our universities and colleges should have Schools of Social Science, not merely Departments of Economics, History, etc. History can be as meaningless as economic statistics when recorded by someone who is interested only in what he calls the "facts," when produced by those without a "theory." Give us more history by those reasonably well-trained in economics and more economics by those reasonably well-trained in history.

Solon J. Buck knew some economics; otherwise he would never have produced his excellent work, *The Granger Movement*.[1] Arthur Schlesinger was interested in the whole gamut of social problems; otherwise he could never have produced *The Age of Jackson*.[2] Economic interpretations of history should be both the tools and the products of economists and historians. Beard's work[3] is a landmark in the synthesis of political economy and history. Some of it has been facetiously called "criminal" rather than "economic" interpretation. But the fact is that men are both stupid and wise, both vicious and righteous, and some of both kinds have been known in high places. A scientific history will record the deeds of both.

I would select for heads of the Schools of Social Science men well trained in all the social sciences, generalists rather than specialists. These men should be men with ideas, men trained to think, not merely experts in the mechanics of a given discipline. As heads of Schools, moreover, they would need to have the native ability and personality essential for good academic administration. I would staff these Schools with specialists in the various social disciplines, including agricultural economics and history, and would select for such jobs only people who also had at least a fair acquaintance with the other social disciplines as well as a thorough knowledge of their own specialties.

But you might ask, from where would you recruit such a staff? I admit the difficulty, but this only emphasizes the importance of

[1] *The Granger Movement*, by Solon J. Buck, Harvard University Press, 1933.

[2] *The Age of Jackson*, by Arthur M. Schlesinger, Jr., Little, Brown and Company, 1946.

[3] *An Economic Interpretation of the Constitution of the United States*, by Charles A. Beard, The Macmillan Company, 1913.

beginning to train men who can qualify under such specifications. Training of this kind involves discontinuance of the practice, still too prevalent, of granting advanced degrees in social science to people whose training has been largely restricted to their specialty.

Methods in agricultural economics differ from those of other branches of economics only as the subject matter and problems differ. In my judgment, the similarities are more important than the differences. The late John Maynard Keynes has said,

"... The study of economics does not seem to require any specialised gifts of an unusually high order. Is it not, intellectually regarded, a very easy subject compared with the higher branches of philosophy and pure science? Yet good, or even competent, economists are the rarest of birds. An easy subject, at which very few excel! The paradox finds its explanation, perhaps in that the master-economist must possess a rare *combination* of gifts. He must reach a high standard in several different directions and must combine talents not often found together. He must be mathematician, *historian*, statesman, philosopher—in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man's nature or his institutions must lie entirely outside his regard. He must be purposeful and disinterested in a simultaneous mood; as aloof and incorruptible as an artist, yet sometimes as near the earth as a politician." (Italics mine).[4]

Note that Keynes' ideal of "many-sidedness" in the qualifications of a "master" economist includes proficiency as a historian. Apparently, also, his conception of a master economist is different from what is usually called a "leading" economist, for a leading economist is often nothing more than a leader of a particular "fraternity" of economists. As such, he may be more of a salesman than a social scientist.

I agree with this quotation from Keynes and consider it a classic; but I follow the late John R. Commons and go much further. After sixty years of many-sided and acute study of human affairs, as well as active participation in dealing with economic and social problems, he wrote,

"As I have studied practical problems it has always seemed to me that the life and death struggle of making a living and trying to get rich was at the

[4] *Memorials of Alfred Marshall*, ed. by A.C. Pigou, McMillan and Company, Lt., London, 1925, Chapter II, page 12, a biographical sketch of Alfred Marshall, 1812–1924, by J. M. Keynes.

bottom of all other problems. Out of this basic struggle come political parties, constitutional governments, labor unions, corporations and so on. Always I worked out to some administrative task, but the administration grew out of the underlying struggle for making a living. Consequently, I have never been able to think of the various social sciences as separate fields of history, political science, law, economics, ethics and administration. What we need is some way of working through the whole complex of problems that grow out of this fundamental struggle."[5]

What is that way? Commons found it in the "transaction" and in the "going concern." Others have not only failed to find it at all, but continue to hold to the neo-classical position that a separate science of economics can and should be developed and taught without too much relation to other social disciplines, such as jurisprudence, political science, psychology, anthropology, and philosophy.

Both quotations from these two master economists emphasize the importance of history to the economist. Economists have argued long and vigorously over the relation of economics to history. From Schmöller's debates with Menger to the present day, professional economists have argued the relative merits of the historical, statistical, and inductive methods versus the "theoretical," abstract, logical, and deductive methods. As is generally the case in most arguments, it has always seemed to me that both sides were right and wrong. Each was right in insisting upon the use of the methods advocated, and each was wrong in over-emphasizing the importance of its method as contrasted with that advocated by the opposition.

That the importance of the historical method was recognized early in the development of agricultural economics in this country is indicated by the very name of one of the Divisions of the Bureau of Agricultural Economics, namely, the Division of Statistical and Historical Research. But what is the significance of using both of these words in the name of this Division? Isn't every "statistical" time series also "historical?" Isn't the Agricultural Census part of the economic history of agriculture? Yes, but statistics and statistical method are concerned with more than the maintenance of time series. They are the language of numbers, and aid in the understanding of all things measurable in social science. And history includes much more than can be treated statistically.

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[5] From an unpublished manuscript entitled *Economics of Collective Action*, page 132.

I believe the trend in American universities and colleges is toward a broadening of the training of people specializing in the various social disciplines. One example I consider to be a move in the right direction is the establishment of schools of "public administration." I should like it much better if these schools had been established as schools of "social science" with curricula appropriate for that title. But what has been done is at least a recognition of two facts of life: (1) that the number of people needed to administer all kinds of government "action" programs has increased enormously in recent years, and (2) that the training of a good administrator should include more than economics, since he must draw upon all the social disciplines, and these are never found in mutually exclusive compartments.

Administrators need a comprehensive understanding of social science lest under the pressure of their work and in their concern with routine matters they lose sight of where the "economy" has been and all sense of direction as to where it is going or ought to go. Because policy is being made more and more by administrators, and because administration is providing increasing opportunity for the kind of research through which one *learns by doing*, it is ever more important that those in key administrative posts understand the social implications of what they are doing—in other words, have social *perspective*.

Agricultural economists, of course, should know something about agriculture, but as economists they should be first of all social scientists. The word "agriculture" should distinguish them from other social scientists only as it differentiates their background and the type of problem they are interested in or working on. A good knowledge of history is an indispensable part of their training and some knowledge of how to do historical research is a necessary tool in their work. They should not be demoted, however, if they cannot answer from memory, "What is meant by Shay's Rebellion?"

As for master economists it may well be that these cannot be trained. Maybe they just grow. The bald truth is that the proportion of students both able and willing to study comprehensively in the field of social science is small. It is even probable that the market for the services of such people is thin; whereas a job is waiting for the fellow who knows the mechanics of peanut marketing or the advanced techniques of farm cost accounting. But a good administrator who has the inquisitive mind of a research worker and has the

responsibility for making policy decisions, will also have a lively interest in both the relevant facts of the past and an economic theory that will help him understand what he is doing. Both those interested in the maintenance of the "status quo" and those concerned with improving existing institutions have a ready use for the findings of social science. But the study of that discipline can flourish best in an atmosphere of free inquiry.

Today, knowledge of agricultural economics in its larger social science setting is especially important as mankind tries to write some important history for the future. We face many new and imperfectly understood situations as well as a considerable area of absolute and abysmal ignorance. All of us nurse the hope that this Nation and the world are standing at the threshold of a great new age. But none of us can fail to be aware that many dangers lie between us and that goal. We cannot even know what all the dangers will be. On the other hand, I am convinced that even the most sanguine of us is hardly likely to envision the half of what this age, now dawning, offers to man in terms of material, intellectual, and spiritual advancement. The broadening character of the economic matters with which we are dealing today as compared with a few years ago is both a token and a promise of the future. Along with more cataclysmic events, this is itself an indication that "One World" is more than a catchword; it is a developing entity with which we are already having to deal, both at home as between agriculture, industry, and trade, and in the world as a whole.

DISCUSSION: AGRICULTURAL ECONOMICS AND HISTORY*

WILBUR H. GLOVER
Wisconsin Historical Society

THERE are difficulties on both sides in bringing about an active collaboration between agricultural economists and historians. The theoretical approach to a social situation often results in an analysis which is static in its nature; movement and change is eliminated to make a "snapshot" of things as they stand at a given instant. This procedure clarifies a situation for an administrative operation, but the patient may suffer unless the operators realize that life cannot be frozen into a fixed posture. It is at this critical point that the habits of historians may prove useful. The historian's constant regard for change may profitably be employed to avoid the assumption that agricultural policy may be based on "laws" of human behavior derived from the most perfect analytical study of any single situation.

The historian's function is to provide a clear understanding of the dynamic factors operating in our society. Fully developed, this function makes the historian indispensable to the analytical subjects like economics. It remains to be seen whether the historical profession has any wish to become indispensable. The historians' special enthusiasms have led them to an other-wordly concentration, not upon subject-matter or social problems, but upon the materials of historical research. As Toynbee has observed, history has tended to become an industry whose objectives have been dictated, not by the cogency of the problem, but by the availability of material for "original" research. A further limitation in the choice of study materials has been imposed by the apparently deeply-felt duty of historians to rationalize and promote nationalistic attitudes and developments. Subject-matter of the standard history texts customarily centers about the nation-state; economic matters have only recently been made respectable by Charles A. Beard's dictum that it is economics which control politics, a distortion which has secured the useful purpose of getting economic matter into the texts.

The extent to which nationalist enthusiasm has penetrated scholarly history is illustrated by the absorption of many scholars whose natural bent appears to be for agricultural history into the mystic coils of the frontier theory. The idea that the frontier experience has been a critical factor in our development rang the bells in many minds searching for a criterion which would distinguish Americans from their brothers in the Western Civilization, a necessity traceable only to patriotic fervor. The consequence is that solid agricultural history—the relation of man to the land—has been neglected in favor of the production of rather mediocre poetry hymning the American virtues of self-reliance and directness in a

* Discussion given at the annual meeting of the American Farm Economic Association, Green Lake, Wisconsin, September 10, 1947.

manner designed to make us rejoice that we do not "belong to other nations." It is doubtful whether Turner, who was trying to explain certain developments of Wisconsin history, had in mind any such sweeping notions when he formulated his classic statement.

The problem confronting this group is how to convert such devotion, imagination, and enthusiasm to more specific and immediate ends. If the American nation can now be conceded to be a fact, it is possible that certain problems of its people may be examined with a view to taking action on them. Among these problems are those upon which agricultural economists are engaged. To historians contemplating the world with an idea of beginning to study it somewhere it is important to ask whether those problems invite their collaboration.

As an historian I propose to investigate this question historically, by referring to the work of the Department of Agricultural Economics of the University of Wisconsin, which I recently found it necessary to consider. With the beginning of the Department in 1909 historical study began. H. C. Taylor proposed history as one of the tools of research required by the nature of the materials he hoped to reduce to order, and from his faith in the method the classic works of Falconer, Bidwell, and Gray emerged. Hibbard's joining the Department added another whose basic method was genetic and dynamic, and from him we have had extensive contributions to the history of farmers' movements and public land policy. The interest in farm politics was by no means idly academic; dealing with market problems brought the staff face to face with aroused and organized farm groups which it was safer to comprehend; no one is in better position to appreciate the qualities of high explosives than those who handle them. The interest of Hibbard and others in land policy was no less cogent and active. Agriculture means land; land tenure influences management. Following this normal line brought the Department not only to the publication of standard histories but to the contemplation of Wisconsin's own special "frontier," the northern cutover.

At this point this slight historical survey points distinctly forward. Hibbard was joined by George Wehrwein, whose own historical interests ranged from Manitowoc County to ancient Palestine, and the Department attacked the underlying uncertainties of dealing with the land problem of northern Wisconsin. The development of a powerful effort on the spot to bring order out of chaos of a frontier in retreat has provided encouragement to the scholarly attempts to penetrate the mysteries of such a social situtation.

As things now stand in the Department its members feel that there must be developed satisfactory historical data on the agencies and attitudes which brought northern Wisconsin to its present state as an essential basis for analysis that may serve to aid ultimate solutions to a real and pressing social dilemma. The explosive potentialities of the farmers' cooperative movement, now on the verge of an economic triumph or perhaps a destructive war of attrition with private enterprise, has made the marketing specialists aware of the need of histories of co-operation. The students of farm tenure have been ransacking the state for the histories of groups that

have or have not made a success of ownership continuity, and research in farm management does not ignore the social pressures that have shaped its decisions in the past.

These approaches by the Wisconsin Department to a union of history and economics have the advantage not only of beginning at critical points where excitement and color can be guaranteed, but also possess the further merit of leading toward conclusions that can actually be tested. Historians may easily choose to absorb themselves in tricky source materials and win approbation within their profession by the astuteness of their penetration. The only trouble is that there is no way of checking their results in very many cases. Economists and others are seizing an advantage by dealing with matters in which future developments provide an inexorable judgment on their fallibility. However, historians have often dealt with the active materials of social development, and the greatest practitioners among them have taken risks in choosing to outline stories which might have been stranded by later growths. Bancroft and the nationalists won their gamble in the choice of subject; Eggleston, who chose to deal in terms of culture itself, is only now being rescued from near-oblivion by the boldness of Toynbee, who is attacking the disease of nation-worship with all the weapons of a formidable armory. Other historians will succeed as they deal with the stuff of social dynamics. Agricultural economists have an interesting set of invitations in their hands which they should proffer with insistence.

DISCUSSION*

THEODORE SALOUTOS

Really it is gratifying to hear from a farm economist that history has other than cultural values. It can be made to have a utilitarian value. even though some historians would scoff at the mere suggestion of this. Properly guided historical research projects can be used to great advantage in directing policies. Of late even such agencies as the army and navy have realized the value that history can have in the formation of naval and military policies, and historians are being encouraged to develop the fields of military and naval history for this very purpose.

One can heartily agree with Allin and his emphasis on the need for a greater integration of history and agricultural economics. This is a must for the historian of the farm problem. The "historical roots" approach is inescapable. Historians know better than others that things do not occur over night, over a month, or over a year. The farm problem is the result of a cumulative process.

Unfortunately the farm economists have not had the assistance from the historians that they should have had. For one thing, historians lack

* A discussion given at the annual meeting of the American Farm Economic Association, Green Lake, Wisconsin, September 10, 1947.

a certain type of specialized training, which in my opinion is necessary, and in this respect I take exception to Allin's statement that history along with agricultural economics is over-specialized. Historians need better, perhaps more specialized training in such related fields as taxation, monetary and fiscal policy, competition, agricultural tariffs, international trade, marketing and labor policy. Nowhere does this need become more apparent than when the historian attempts to tackle the farm question of the twenties and thirties. More than simply farm economics is required, and equally more than history. What the farm economist lacks in breadth of approach he makes up for in the possession of certain specific tools and skills, and what the historian lacks in the sense of specialization he compensates for partly because of his comprehensiveness. A far more ideal situation would result if the mentioned qualities of the two disciplines were blended into one. The farm economist can point with some degree of precision to the problems that need historical treatment and the historian can proceed to tackle them. Specifically, the historian should try to maintain a proper balance between specialization and comprehensiveness.

The historians have not been of much aid to the farm economists for reasons other than they have been handicapped for the want of a certain type of specialized training. For one thing the economist is concerned with the present day problem, while the historians have given little consideration to the problems of the post World War I era let alone the World War II era. And this they have refrained from doing for obvious reasons. This period is too recent. Twenty or thirty years is not much of a time span for the historian. Enough time has not elapsed to give the historian the necessary perspective. Furthermore, too many of us are too close to our prejudices and preferences.

I am not sure that I share Allin's enthusiasm for the Schools of Social Science which he proposes to establish in the place of History and Economics Departments. The idea of having well-grounded professors and students in history, economics, political science, and the other related disciplines is a perfectly laudable one. This recommendation is in line with the growing interest in the integrated courses to which many universities and colleges are exposed at the present time. Such integrated courses can fill much felt needs in breaking down some of the academic fences that have been built up. If integrated courses it must be, these proposed courses should be entrusted to people who have faith in this particular brand of integration, and not in the hands of young Ph.D's just out of graduate schools, who are the products of specialists and who despise and resent teaching courses in which they have no special interest, and which they know their senior colleagues hold in contempt.

One wonders if the same objective of breadth and integration could not be attained by having historians, economists and political scientists better rounded in related disciplines and teaching within their respective departments rather than setting up Schools of Social Science. Maybe many students get very little integration of subject matter out of their present courses in history and economics, but I am not sure that Schools of Social

Science will remedy things. This can well be an instance of where the cure is worse than the disease itself.

It seems that historians can put to greater use the findings of farm economists that have appeared in the multitudinous state and federal bulletins issued. Here is a wealth of information that has been ignored by historians for the most part.

Despite one's criticism of the historian, the historian has a very valuable role to perform. He has a keen appreciation of the political, and especially the personal, factor which many economists are prone to ignore. For instance who can hope to write a full and comprehensive account of the New Deal without treatment of men like Roosevelt and Wallace. A history of this period would be incomplete without treatment of these men. Whether right or wrong, their positions, their influence, and their reliance on public support had as much, if not more, to do with policies adopted than had the seasoned views of the economists.

Besides the political factor and the personal equation, the historian is ably trained to handle source materials that many economists would ignore or overlook. In this respect, farm economists who have been called to Washington to counsel and advise can perform an invaluable service to posterity if they preserved data and correspondence which they have accumulated in the course of this service. Dr. Henry Taylor's memoirs are a step in this direction. Correspondence of men like Frank Lowden, William Hirth of the Missouri Farmers' Association and George N. Peek are being made, or are about to be made accessible to scholars. More of this type of manuscript material should be collected and preserved.

Briefly then, the historian can profit from some of the specialized training which the farm economist has received in the various categories mentioned. But these specialized categories should be subjected to the general over-all picture which the historian is better prepared to present.

NOTES

ESTIMATING CASH CONSIDERATIONS IN REAL ESTATE TRANSFERS FROM INTERNAL REVENUE STAMPS*

INTERNAL revenue stamps attached to deed records are useful in measuring the cash consideration in real estate transfers. To use the revenue stamp for this purpose it must be assumed that the amount of the stamp predicates the actual cash consideration in the transfer. The soundness of this assumption depends first on the integrity of parties to the transfer. It depends also in no small degree on the middlemen on the land market as well as the county recorder. Many county recorders perform the extra service of reminding the parties to land transfers to attach the correct amount of stamps while others regard this indifferently.

If the distribution of the values of parcels of land were uniformly distributed according to size it would theoretically be correct to assign the cash value of the midpoint of the stamp-class interval as the cash represented by a particular amount of stamps. Excepting the 55-cent class, which indicates from $100 to $500 cash, the formula would then become—

$$\text{Dollars of cash} = \frac{\text{Dollars of rev.}}{1.1} \times 1000 - \$250.$$

Actually this formula does not present the correct results. An analysis of records in which both the cash consideration and the revenue stamps are shown points to the fact that this formula gives a cash value that is too low.

Excepting a minor correction (Sheppard's) it can be assumed that buyers will on the average pay $.55 internal revenue for the last $250 of cash if a normal continuous distribution is assumed. Table 1, which is based on 5,011 records in which both the revenue and the cash are shown, gives the average amount of cash represented by the last $.55 of revenue. Note that in all cases it is very much above the $250. The answer is that the distribution is not continuous, and probably abnormal. The abnormalcy may be the result of the nature of the property being studied. The real estate may be

* Approved by the Director of the Idaho Experiment Station as Research Paper No. 280.

rather sharply delineated into value classes. For example. Canyon County, upon which Table 1 is based, is made up of both very good irrigated land and poor desert land. Because land of a given class tends to have *per-acre* value and the United States policies of parcelization of land created certain sizes such as forties, eighties and quarters there is a preponderance of parcel values for these sizes.

TABLE 1. INTERNAL REVENUE STAMPS AND CASH CONSIDERATIONS IN DEED RECORDS, CANYON COUNTY, IDAHO, 1936–1946

Amount of revenue stamps	Number of transfers	Percent at upper limit	Average amount of cash for last $0.55 revenue
(*dollars*)			(*dollars*)
0.55	1102	13.7	295.93*
1.10	874	24.7	284.94
1.65	479	32.8	336.67
2.20	487	38.8	339.87
2.75	369	43.0	361.62
3.30	379	38.5	332.17
3.85	272	47.4	356.08
4.40	205	48.3	369.60
4.95	154	48.1	365.81
5.50	139	59.0	395.13
6.05	99	47.5	373.78
6.60	102	57.9	402.80
7.15	55	49.1	397.57
7.70	70	57.2	408.03
8.25	38	52.7	395.74
8.80	44	72.7	436.80
9.35	22	68.2	427.68
9.90	19	84.2	461.90
10.45	8	75.1	412.50
11.00	15	86.7	468.47
11.55 & over	79	91.1	473.57

* Since the first $100 is exempt, the midpoint of this class is $300 compared with $250 for the other classes.

In this particular analysis much of this has been corrected because the data were gathered for a period of years showing changing price levels, thus gradually shading one value class into the next so as to make the aggregate of all the years a more nearly continuous statistical universe. In areas of more gradient land qualities this factor is less important because the per-acre is truly more variable instead of stratified.

In order that the distribution of the values of parcels of land transferred be of a continuous nature it would be necessary that the number of dollars making up a *bargaining unit* be infinitesmal. This, of course, is not the case. Note in Table 1 that in general the majority of the cash considerations are at the upper limit of the stamp-class interval. This means either that the actual cash consideration was a multiple of $500 or the parties to these transactions have rounded off the report of the cash amount *within* a revenue class. Legally the reporting could be rounded upwards only but in most cases this is unlikely under our present conditions of income tax. It is probably more likely that the bargaining unit has been $500 or a multiple of $500. Note from the table that there is a direct correlation between the percentage at the upper limit and the amount of revenue stamps. It is to be expected that this would be the case if it is a matter of bargaining units because the $500 in question would loom larger and would more likely be split in smaller transactions.

It is evident from the data that not only does the cash consideration tend to be rounded to multiples of $500 but also to multiples of $1000. In the range of cash considerations of from over $2,500 to $10,000 (revenue stamps from $3.30 to $11.00 a total of 60 percent of the cash considerations were in the stamp classes indicating multiples of $1,000 for urban real estate and 62 percent for rural. In this area cash considerations have been rounded off more frequently when rural property rather than urban has been involved. Logical reasons for this are somewhat speculative. However it is true that farm real estate, especially if farmsteads are involved, is more difficult to evaluate than the real estate in the typical urban transfer, which is residential. More arbitrary figures are more likely to be rounded by the layman.

Adjustment for the skewed distribution in the last stamp-class interval evidently does not generally place considerations estimated from the revenue stamps on a par with considerations obtained through interview or questionnaire methods. A study[1] made in 1941 showed that considerations received from questionnaires were 14 percent higher than those estimated from revenue stamps. However, considerations stated on the deed records were only 2

[1] Norman Nybroten, *Land Values, Mortgages, Rents, and Wheat Yields of Northern Idaho Wheat Lands*, University of Idaho, Agricultural Experiment Station, Bul. No. 249

percent higher than those derived from revenue stamps. Many errors no doubt creep into the valuations available to the research worker through these methods but even with this as a limitation averages can be used quite confidently for many purposes. If the analysis depends on individual valuations, certain cautions should be taken and corrections made. It is evident that if the revenue stamps on a real estate transfer indicate a cash consideration of $5,000 or more there is more than a 50–50 chance that the amount of cash involved is all that is allowed for the stamps shown. However, if the task is to appraise an area by expanding a sample of real estate transfers within the area it is more accurate to use an empirical average to impute the cash amount represented by the last $0.55 of revenue.

NORMAN NYBROTEN

University of Idaho

CAN SUFFICIENT PRIVATE CREDIT BE OBTAINED FOR FHA INSURED FARM REAL ESTATE LOANS?

THE Farmers Home Administration Act of 1946 provides for the use of private credit for insured real estate loans to promote owner-operatorship of farms.[1] However, certain conditions raise doubts as to whether sufficient funds will be forthcoming to finance the program. Although commercial banks are not the only agency eligible to participate, presumably they will be the main source of credit. This discussion is written chiefly from this viewpoint. This paper examines the proposition that the present legislation will attract only a small portion of the $100 million maximum of credit set by the Act.[2] The proposition is considered in terms of (1) the interest rate, (2) use of private credit for long-term farm-mortgage lending, and (3) supervision and collection. It is not the purpose here to appraise the objectives of the Act.

The Act provides for insurance of the loans by the Federal Gov-

[1] Public Law 731—79th Congress; Ch. 964—2d Sess; HR 5991. Title I—Tenant Purchase Loans and Mortgage Insurance.

[2] An administrative monetary size limitation of $12,000, high land prices, and high farm incomes have restricted the program to a relatively few loans since passage of the Act. As of March 31, 1948, 251 loans had been approved in the United States. Of this number, 116 had been closed in the amount of $815,602 or only .8 of one percent of the annual maximum. (Letter from Paul V. Maris, Director, Farm Ownership Division, FHA, Washington D. C.).

ernment. The borrower pays a fixed interest rate of 3.50 percent on the unpaid principal; 2.50 percent goes to the lender, 0.50 percent to the FHA for supervision and collection, and 0.50 percent to the insurance fund. Supposedly the lender has little cost except that related to supplying the money. Loans are written for 40 years but they must be transferred from the FHA when the financial situation of the borrower qualifies him for credit from usual sources.[3] This means that after the loan has been amortized for 15 years, it will be placed on about the level of requirements of federal land banks.

Many factors influence the rate of interest charged by commercial banks on farm real estate loans, and these result in numerous variations between banks and areas. However, under the FHA Act many of the variations in interest rates become relatively unimportant to the lender. The insurance phase eliminates the risk element to the lender. Variations in servicing charges due to such characteristics as size of loan are less important than usual because supervision and collection costs are borne by the FHA. Area variations arise mainly because of differences in alternative investments open to the lender for use of excess reserves and differences in the supply of funds available for lending which arise because of distance from money centers.

The most important question in connection with availability of private credit is concerned with the 2.50 percent interest rate. For example. banks can now obtain blocks of long-term Government bonds at about 2.39 percent and with the present support price of 101, the yield is 2.43 percent. Federal Housing Insured Mortgages are reported to be selling at prices to yield about 3.60 percent after servicing costs.[4] These and other investments not only yield returns more favorable than FHA real estate loans but also more nearly maintain the liquidity of the banks.[5] Why should bankers

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[3] Section 5 of H.R. 6114, 80th Cong. 2d sess., introduced April 2, 1948, provides that the Secretary may agree with the holder of the mortgage to purchase the mortgage at the holders option not less than 5 years from the date of the insured mortgage

[4] Harold C. Larsen, and Roy J. Burroughs—"Farmers' Home Administration Act of 1946." *Agr. Finance Rev. BAE—USDA.* Vol. 9 Nov. 1946.

[5] In March, President Joseph M. Dodge of the American Bankers Association, in a New York city address, said the increased income now available on prime securities tends to make mortgages at present interest rates "look less attractive" to bank investors and that banks frequently overestimate the actual net return from their mortgage investments. The Equitable Life Assurance Society—*Farm Loan News.* No. 47. April 1948.

be interested in long-term 2.50 percent loans under the FHA program?

Obviously, the first change which many suggest is a higher interest rate. In fact, already there is under consideration the increasing of the rate to lenders to 3 percent.[6] Little information is available as to the actual cost to the banks of lending money, including acquisition of the money and servicing the loan. However, it appears that banks operate on an average fixed cost, applying this average cost to each dollar loaned and thus ignoring the marginal return concept. But if a bank cannot lend all its excess reserves at 4 or 5 percent, for example, would it not be profitable to lend part of them at a lower rate, rather than let some money lie idle? In effect, the FHA program proposes the substitution of private funds for federal funds and opens a new lending field. It is new because FHA clients cannot qualify elsewhere for credit on "reasonable" terms.[7] If it is a question of some income or none to the banks, it appears to their advantage to participate in the program. To date, banks generally have not viewed interest rates on such a basis. Another point worth noting by the banks is that the government carries the loan until the indebtedness is reduced materially at which time the bank has an opportunity to take over the mortgage as a regular loan.

It is desirable to remove some of the rigidity of the fixed interest rate which assumes the same credit situation in all areas of the country. It is possible that funds are available at 2.50 percent in one section but not in another, because of differences in the supply of funds in terms of alternative investments. As interest rates also change over time, an allowance should be made in this respect too. There is indication that interest rates now are increasing and that the money market is becoming tighter.[8] This will cause the banks to be even less liberal with their funds at 2.50 percent. The maximum rate must be raised in order to permit variations as to time and place.[9] The actual rate charged would then depend on factors

[6] H.R. 6114. 80th Cong. 2d Sess. Introduced April 2, 1948, includes 0.50 percent increase in interest rate.

[7] Credit must be available elsewhere to meet the needs of the client at rates not exceeding 5 percent and terms prevailing in the community in or near which the applicant resides. Title I–Sec. 2b.

[8] For example, interest rates on farm mortgages as shown by the *BAE Land Market Survey*, were higher during the latter part of 1947 than they had been in several preceding years.

[9] The Federal Housing Insured mortgage program writes mortgages up to slightly

such as alternative investments for the lenders, features of the Act, and bargaining processes. Provisions could be made for the FHA administrator to set the rates but this has some unfavorable political and arbitrary aspects. Also, it is important that lenders and borrowers give proper weight to factors other than the absolute amount of interest, some of which are suggested in this paper.

Commercial banks have a primary obligation to their depositors. They are very cautious about lending money on farm real estate which ties up funds that may be needed if incomes and deposits decline drastically. Their position is one of a compromise between liquidity and profits. Unfortunately private bank credit becomes tighter during depression periods when the credit is often most needed. It is quite obvious that banks are making a special effort to prevent a recurrence of the early thirties. In 1922 commercial banks held more than $1,500 million in farm real estate loans compared with $765 million in July, 1947[10] and the difference is relatively greater than is shown by the figures if the over-all financial situation is considered. The FHA Act provides a maximum annually of $100 million in loans under the insured phase of the program which represents a significant portion of the total farm mortgages now held by commercial banks. However, on the basis of their present strong financial situation, banks are far from a position comparable to that of the twenties and thirties.

Insured deposit accounts alter the situation from that of previous years and may change the attitude of bankers toward real estate lending. Government farm mortgage insurance should also alleviate this obstacle somewhat and permit expansion of farm mortgages by commercial banks. The establishment of a ready market for the FHA insured mortgages is desirable so that banks can easily sell or obtain credit on them as the occasion demands. At present there is no adequate method of handling these mortgages which will be available in small amounts and odd sizes. A market similar to that developed for Federal Housing Insured mortgages offers a possible remedy for this situation. The secondary market for Housing

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more than 20 years. The maximum rate to the lender is 4.50 percent but a rate lower than this may be charged. In addition, 0.50 percent each year on the original amount of the loan is paid into the insurance fund by the borrower. The administrator of the program may increase the maximum interest rate 1 percent in areas where money cannot be obtained at the regular rate.

[10] *Agr. Finance Rev.—BAE—USDA.* Vol. 10, Nov. 1947.

mortgages has been established by the RFC and this might be done for the FHA mortgages. It is also possible for Federal Reserve Banks to lend to commercial banks on paper held by them and the Federal Reserve Act has a provision which may permit FHA mortgages to become the basis for credit but at a penalty rate.

Another criticism by bankers concerns administration of the loan. The objections are (1) that actually the bank will be required to incur more administrative expenses than appears on the surface of the Act, and (2) that the bankers want to have closer dealings with the farmer and would prefer doing the administration and supervisory work. It appears that bankers feel they will have numerous dealings with the borrower even though it is the intent of the legislation that FHA do all this work. With respect to the second item, FHA maintains that it is principally its supervision which has made the tenant-purchase program successful. Obviously, the success of the program has also resulted in no small part because it has operated in a period of increasing farm incomes. It is also true that most commercial banks do not have employees who are qualified to make adequate farm real estate loans and to supervise in a manner similar to that done by the FHA. Perhaps a compromise in the insurance program would be administration by the lending agency and handling of the insurance by the FHA. Since the FHA would have to investigate the original loan for insurance purposes, its personnel could be utilized in an advisory capacity in helping plan and supervise the farm organization. This system would require an increase in interest to the lender as payment for the additional paper and collection work.

Several other factors enter into the desirability of bankers' cooperation with the program. Some bankers probably will make a few loans as a policy of good-will maintenance. Also, cooperation on the program may bring other business, such as short-term loans. On the other hand, many lenders object to such high-encumbrance lending as provided for by the Act and some also feel that it may reduce the banks from bona fide lending agencies to the status of merely disbursing funds on Government guarantee. In part, these are related to objectives of the Act but they are important in determining the attitudes of bankers toward the FHA program.

The program is faced with a situation arising out of a combination of characteristics of the banking system and attitudes of bankers which is not conducive to long-term farm real estate loans.

Improvements of the market for insured mortgages, insurance of the loan, changes in administration features, and adjustments in the interest rate would help to overcome some of these obstacles. As the Act now reads, it is doubtful whether loans made by private credit agencies will be more than a small part of the maximum amount provided for by the program.

CLYDE E. STEWART

Bureau of Agricultural Economics

RELATION OF FEED, LABOR, AND OTHER COSTS TO BUTTERFAT TEST*

THE question of the additional costs involved in producing high-test milk has concerned the dairy scientist and the practical farmer for many years. The amount of feed required for producing high-test milk has been carefully studied by both Gaines[1] and Morrison.[2] Their studies indicate that an increase of about 1.6% in total digestible nutrients is required for each one-tenth percent increase in butterfat test based on 3.5 percent milk. Hyre[3] studied the problem by relating the amount of feed to the butterfat test using D.H.I.A. data on individual cows which were grouped by test for analysis. He concluded that feed requirements increased 1.8 percent for each one-tenth increase in butterfat test based on 3.7 percent milk.

These results provide valuable evidence concerning the additional feed inputs involved in providing high-test milk, but there still remains the question of what the results would be on average dairy farms and using the entire herd as the basis rather than the records of individual cows. Furthermore, since feed constitutes only about 50 percent of the total cost of producing milk, studies to date have covered only one-half of the inputs which may be involved in producing milk of varying butterfat test. The following

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* Authorized for publication on June 26, 1948 as paper No. 1448 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

[1] W. L. Gaines, *The Energy Basis for Measuring Milk Yield in Dairy Cows*, Circular 308, Illinois Agricultural Experiment Station.

[2] F. B. Morrison, *Feeds and Feeding*, 20th Edition, Morrison Publishing Company, Ithaca, New York.

[3] F. M. Hyre, *Butterfat Price Differentials for Fluid Milk*, Bulletin 248, Agricultural Experiment Station, Rhode Island State College, January 1935.

analysis attempts to provide information on these gaps in our understanding of the relation of the butterfat test of milk to the inputs used in its production.

Source of Data

In the summer of 1946 the Department of Agricultural Economics and Rural Sociology of The Pennsylvania State College interviewed 761 dairy farmers to obtain information on their costs in producing milk for the preceding 12 months. Detailed information was obtained on the quantity and value of all items used by these dairymen in the production of milk for fluid consumption. These records provided a cross section of dairymen in the state, since they were obtained from 25 purposefully selected areas covering the three principal milksheds of Pittsburgh, Philadelphia and New York. Data were obtained from all dairymen in the 25 areas who would cooperate provided they had an average of 6 cows or more and sold fluid milk for at least 9 months of the preceding year. Critical evaluation of the records resulted in the elimination 41, leaving 720 enterprise records for further analysis. Data on the amounts of feed, labor, and other items used in production were obtained directly from the dairymen, while the information on milk production and butterfat test was obtained from the companies handling the milk.

Method of Analysis

Preliminary examination of the data for use in this problem indicated the need for certain refinements. The most important of these was the elimination of those herds with mixed breeding. This was done on the assumption that these herds were of lower inherent productive ability and since they seemed to be concentrated around the 4 percent butterfat level, including them would have introduced an unknown variable. Also breeds other than Holsteins, Guernseys, and Jerseys were eliminated because of their limited number. These eliminations reduced the total number of farm records to 559.

The first step in the analysis consisted of grouping the farms according to their *average herd test* into classes with each one-tenth of one percent constituting one class, beginning with 3.4 percent and ending with 4.7 percent. Herds with an average test lower than 3.4 percent constituted an indeterminate group with an average test of 3.23 percent. Herds with an average test above 4.7 percent

were divided into two classes having average test of 4.86 and 5.19 hercent. This gave a total of 17 groups. In the statistical analysis each of these groups was considered as a single observation which reduced the calculations to manageable proportions. The data for each group were obtained from the farm totals for all records at that test.

Basic data regarding the number of farm records in each of the

TABLE 1. RELATIONSHIP BETWEEN AVERAGE HERD BUTTERFAT TEST AS GROUPED FOR ANALYSIS AND YEARLY BUTTERFAT PRODUCTION, SIZE OF HERD, POUNDS OF DIGESTIBLE NUTRIENTS AND HOURS OF LABOR PER ONE HUNDRED POUNDS OF MILK, PENNSYLVANIA, 1945–46

Butterfat group	Number of farms	Yearly butterfat production per cow	Cows per herd	Pounds of digestible nutrients per cwt. milk[1]	Hours of labor per cwt. milk
3.23	41	256	17.6	67.5	1.76
3.4	45	279	17.4	68.9	1.82
3.5	57	282	17.4	71.1	2.26
3.6	57	262	16.2	70.9	2.29
3.7	44	275	15.9	75.2	2.39
3.8	35	270	17.0	75.6	2.33
3.9	41	267	15.6	71.1	2.45
4.0	36	256	13.4	72.5	2.85
4.1	23	243	15.9	78.5	2.93
4.2	16	217	14.8	86.7	2.93
4.3	21	273	17.5	81.5	2.25
4.4	29	275	17.7	75.0	2.71
4.5	20	277	16.3	75.1	2.76
4.6	18	285	20.4	78.3	2.31
4.7	22	289	16.1	84.9	2.71
4.86	26	292	14.9	77.7	2.61
5.19	28	315	15.4	74.1	2.45

[1] Total digestible nutrients were calculated on the basis of the research work of R. D. Jennings reported in *Feed Consumption by Livestock, 1910–41.* U.S.D.A. Circular No. 670. It has been found that regardless of the kind of concentrate or quality of roughage used, the percent of digestible nutrients is relatively fixed when they are fed to supplement each other. The amount of total digestible nutrients derived from various classes of feed was as follows: grain 75 percent, hay 45 percent, silage 17 percent and other roughage 20 percent. The nutrients obtained from pasture were not measured.

17 groups, along with the average butterfat production, size of herd, pounds of digestible nutrients, and hours of labor per 100 pounds of milk are shown in table 1. The average annual butterfat production and size of herd are shown because these are two important factors which, in addition to the test of milk, may influence the amounts of input factors used in producing 100 pounds of milk. These data indicate that while there was no apparent relationship

between average herd test and size of herd and the annual rate of butterfat production, there was random variation in these two factors. Since such variation would obscure any relationship that might exist between average herd test and various input factors, the technique of net correlation was employed in establishing the relationship reported below so that the influence of rate of production and size of herd could be held constant.

Results

The coefficient of net correlation between average herd test and pounds of digestible nutrients used per hundred weight of milk was +.785 and according to the *t* test was highly significant.

The increase in amount of digestible nutrients associated with each one-tenth percent increase in butterfat test was .8513 pounds. On the average 70.4 pounds of digestible nutrients were used in producing 100 pounds of 3.5 percent milk exclusive of pasture. The percent increase in total digestible nutrients for each one-tenth increase in butterfat was therefore 1.2 percent (.8513/70.4×100). One factor involved in the difference between this figure and the 1.6 percent increase noted previously in the work of Morrison and Gaines will be considered later.

Labor is the second largest cost item in producing milk, usually accounting for about one-fourth of the total. The relationship between butterfat test and the hours of labor per hundredweight of milk showed an increase of .0464 hours for each increase of one-tenth of one percent in test. (See figure 1.) The coefficient of net correlation was +.794 and according to the *t* test was highly significant. Since the average amount of labor required to produce 100 pounds of 3.5 percent milk was 2.18 hours, the increase was 2.1 percent for each "point" increase in butterfat test.

This increase in the use of labor is due largely to the decrease in the pounds of milk produced by the high-test herds. On a per cow basis the hours of labor used per year were only slightly less for the high-test herds averaging, for example, 174 hours for all the Holstein herds compared with 169 hours for the Guernseys.

Input factors other than feed and labor, termed "other costs," must be determined on a dollar rather than a physical basis. These items are interest on investment, depreciation of capital, depreciation on dairy cows, cost for use of equipment, bedding costs, breeding costs and miscellaneous costs. The combined cost of these items

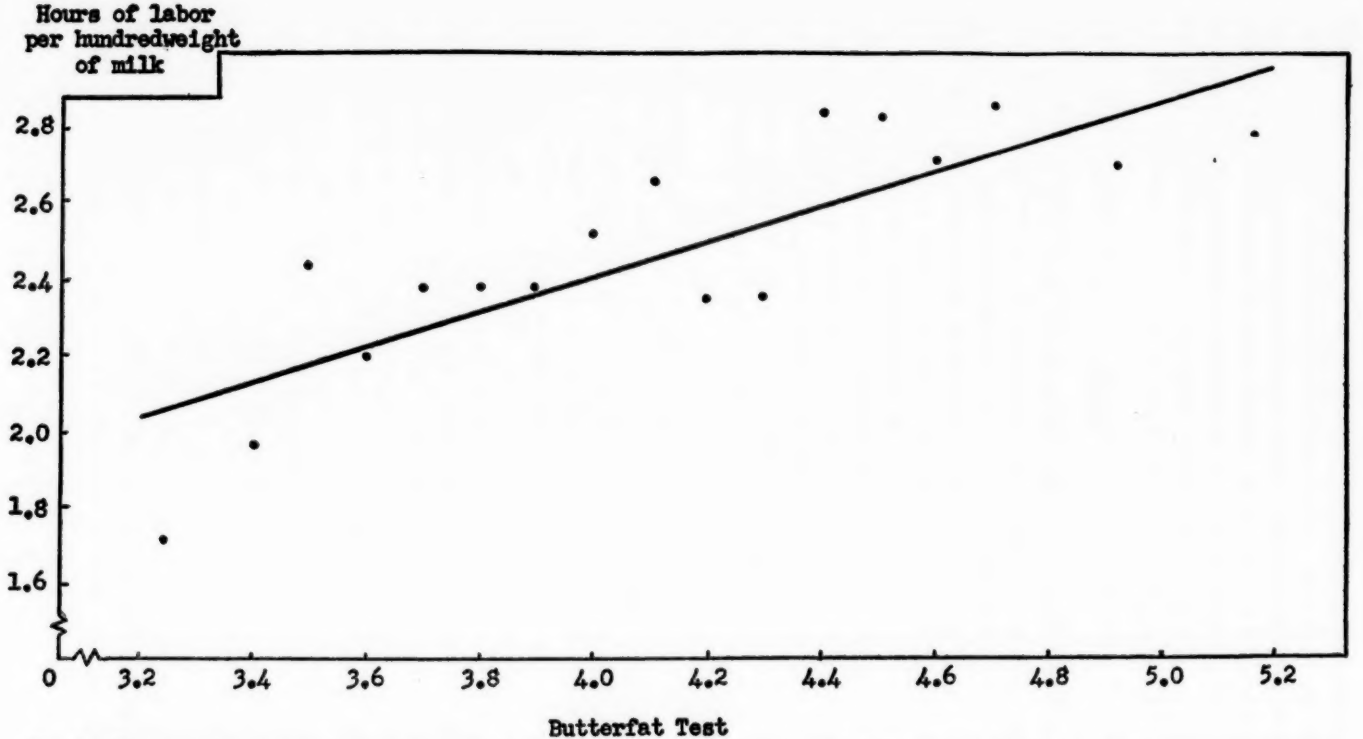

FIG. 1.—RELATIONSHIP BETWEEN BUTTERFAT TEST AND THE ADJUSTED* HOURS OF LABOR USED PER 100 POUNDS OF MILK PRODUCED, 559 FARMS GROUPED INTO 17 BUTTERFAT TEST CLASSES, PENNSYLVANIA, 1945–46.

constitutes about 25 percent of the total cost. By net correlation it was found that for each increase of one-tenth percent in butterfat test "other costs" decreased .1 cent. The coefficient of net correlation was −.54 and according to the *t* test was significant and closely approached being highly significant. This negative relationship was due largely to the fact that the total investment per cow was enough higher in the low-test herds to offset the effect of the higher milk production in these herds on the cost per hundredweight.

The relationship between the average herd butterfat test and total cost of producing 100 pounds of milk was determined by assigning dollar values to all inputs. The physical units of feed and labor used were converted by means of the average state-wide prices.[5] These adjusted costs were added to the "other costs" to get the adjusted total cost.

Using net correlations and holding the annual rate of butterfat production and size of herd constant, it was found that for each increase of one-tenth of one percent in the herd's average butterfat test there was an increase of 5.1 cents in the adjusted total cost of producing 100 pounds of milk. Approximately one-half of this increase in cost was due to an increase in the use of labor per hundredweight and the other half to the increase in feed. The coefficient of net correlation was +.685 and was highly significant according to the *t* test of significance. Since the average cost of 3.5 percent milk was $4.38, the percent increase in cost associated with a one-tenth percent increase in test was 1.14 percent (.05/4.38×100= 1.14%).

The Influence of Price Level on Feed Input

Economic analysis suggests that the high price of milk in 1945–46 was one reason why the percent increase in digestible nutrients was not greater than 1.2 for each one-tenth percent increase in butterfat. This conclusion stems from the fact that the butterfat differential paid producers in Pennsylvania has been at a flat rate, usually 5¢ per tenth, regardless of the base price of milk. Thus when 3.5 milk is selling for $2.50 per hundredweight the producer of

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[4] The hours of labor have been adjusted so that the effect of differences in size of herd and rate of butterfat production would be eliminated and can be assumed to be constant.

[5] The prices used for feed were concentrates at $3.02 per hundredweight, succulents at $7.20 per ton, hay at $21.50 per ton and other roughage at $7.20 per ton. Labor, was charged at the rate of $0.55 per hour.

4.5% milk would receive $3.00 or 20% more. On the other hand if the price of 3.5% milk were $5.00 the producer of 4.5% milk would receive $5.50 or only 10% more. In terms of the milk-feed ratio, there was an increase of only six percent for the producers of high-test milk from 1942 to 1946 compared with an increase of twelve percent for the producers of low-test milk. Thus the economic incentive for the producers of high-test milk to feed more heavily to increase production was considerably less during the period covered by this study than it was for the producers of low-test milk. To the extent that producers adjusted their feeding practices to this situation the relationship shown previously between butterfat test and feed input would be less than if milk prices had been lower.

It was possible to check the above hypothesis of the effect of prices on feeding practices because a study similar to the one in 1946 was conducted in the summer of 1942. The comparison between the two periods was made on the basis of the digestible nutrients used in producing 100 pounds of high- and low-test milk. The high- and low-test groups of producers were determined arbitrarily for both years by using the upper and lower 15 percent of the dairymen arrayed on the basis of butterfat test (table 2).

TABLE 2. COMPARISON BETWEEN 1941–42 SURVEY AND 1945–46 SURVEY OF TOTAL DIGESTIBLE NUTRIENT INTAKE PER HUNDREDWEIGHT OF HIGH- AND LOW-TEST MILK, PENNSYLVANIA

Year of Survey	Total Number of farms	Low-Test Group			High-Test Group		
		Number of farms	Average test	Pounds of Nutrients*	Number of farms	Average test	Pounds of Nutrients*
1941–42	340	48	3.4	62.1	45	4.7	82.1
1945–46	720	146	3.4	69.5	142	4.8	78.3

* Nutrients obtained from pasture were not measured.

In 1941–42 the total digestible nutrients used per 100 pounds of low-test milk was 62.1 pounds; whereas in 1945–46 it was 69.5 pounds. This is an increase of 12 percent which statistically was highly significant. In the high-test group 82.1 pounds of digestible nutrients were used per 100 pounds of milk in 1941–42, while in 1945–46, 78.3 pounds were used or a decrease of five percent. Since there was a small increase in the milk-feed ratio for the high-test group during this period, a decrease in the rate of feeding would not be expected. It is worth noting, therefore, that when tested for

significance, a decrease as large as this could be expected in 20 cases out of 100 from chance variation between the means of two samples.

Two inferences may be drawn from these data on changes in feeding practices. First, the existence of a flat butterfat differential apparently has influenced to some extent the relationship shown previously between butterfat test and the total digestible nutrients used in production. Second, a flat butterfat differential has a detrimental effect on producers as well as consumers. While the latter can not adequately express to producers their desire for milk of varying test, the farmers are faced with the problem of making adjustments to an additional and unnecessary factor influencing profits.[6]

Conclusions

This study indicates clearly that it is inaccurate to assume that all production costs increase in the same proportion as feed costs with increases in butterfat test. Labor costs appear to increase at a faster rate while "other costs" are influenced only slightly by changes in butterfat test. The increase in all costs in 1945–46 of 5.1 cents for each one-tenth percent increase in butterfat test was surprisingly close to the butterfat differential of 5 cents per point in effect at the time.

The use of a flat cent-per-point butterfat differential for fluid milk suggests that the incentive for the production of high-test milk in preference to low-test milk would tend to vary inversely with the base price of milk. This tendency was substantiated by a comparison of the feeding practices of producers of high- and low-test milk in 1941–42 with 1945–46. Consequently, the reported increase in the amount of total digestible nutrients associated with increases in butterfat test might have been somewhat larger if the study had been made during a period when the base price of milk was low.

L. F. MILLER
HOMER J. PRESTON

The Pennsylvania State College

[6] This study was not directed primarily at the problem of the proper amount or method of paying for the butterfat in fluid milk. For a discussion of this point see L. Spencer and S. Johnson's *Price Differential for Butterfat in Market Milk*, A. E. 457, Department of Agricultural Economics, New York State College of Agriculture, Cornell University, Ithaca, New York, September 1943. Also E. G. Misner, *Some Methods of Computing Butterfat Price Differentials*, A. E. 459, Department of Agricultural Economics, New York State College of Agriculture, Cornell University, Ithaca, New York, October 1943.

INVERSE CARRYING CHARGES IN FUTURES MARKETS

IN HIS recent article in this JOURNAL[1] Holbrook Working suggests that any carrying charges reflected in the prices of cash grain and grain futures most usefully and accurately may be considered as the "price of storage." This, Working contends, is the case regardless of whether the carrying charge is positive or negative. This entire suggestion seems to the present writer to be both inadequate and unrealistic as an explanation of price behavior in the grain markets.

It is inadequate because it makes no start towards explaining why the carrying charges are positive at one time and negative at another. To call the differences at a given time between prices of a commodity for two different dates of delivery by a new name,—the price of storage,—seems not to offer any direct clew as to why that price varies from time to time through a pretty large range.

It is unrealistic because whenever there are high inverse carrying charges, terminal grain merchants tend to modify their market transactions so that full contractual storage charges are paid on an increasing proportion of the total grain in store. This they accomplish by decreasing their own ownership of grain and increasing the proportion of stocks in their elevators carried for the accounts of others. On this increased portion of total grain in store full official storage charges are paid. Under these circumstances Working's simple equation no longer holds. That is, it is not true that

$$P_1 + P_s - P_2 = 0 \tag{1}$$

but rather

$$P_1 + P_s - P_2 = \pm x \tag{2}$$

in which equation P_s is the constant standard charge for storage. In equation (1) the real problem is to explain the size of P_s; in equation (2) it is to explain the size of x and this involves direct explanation of both P_1 and P_2. The size of P_s explains or measures only part of the difference between the other two.

Perhaps more than one circumstance affects the relationship between P_1 and P_2. As Working himself says, "downward bias" probably accounts for some tendency for P_1+P_s to be greater than

[1] Vol. 30, No. 1, February 1948, pp. 1–28.

P_2 although as he says this tendency cannot explain more than a small inverse carrying charge.

The insistence of immediate demand relative to supply is, perhaps, the most important factor in determining x in equation (2) above. At least this appears to have been so in the case of the Minneapolis wheat market. Compare, for example, the prices of the December and the following May wheat futures in Minneapolis from 1900 to the present. When the prices are averaged by years for the first business day of each month in which both futures are traded, the December exceeds the May only in 1921 when the post-war foreign demand still was strong and the domestic crop was short, in 1934–37 when the crop was seriously curtailed by drouth, and in the recent years of high post-war foreign demand. In all other years there were positive, although varying carrying charges between these two futures. Similarly, the only years when the cash price of No 1 NS wheat in Minneapolis on January 2nd was above the May future in either Minneapolis or Chicago were those in which the demand was strengthened materially by post-war conditions abroad or the supply was curtailed seriously by drouth.

Whenever supply is conspicuously short relative to demand, buyers bid up the cash and nearby prices in their efforts to obtain actual grain of the desired quality. During 1947–48, for example, it apparently was necessary to bid the price up in order to persuade farmers to sell their wheat. In January,—and even now in April,—the stocks owned by farmers in the Chicago elevators and the stocks remaining on farms have been unusually large. Apparently farmers believed that cash wheat prices would go above their January level. It is equally apparent that some speculators believed prices already were too high and consequently these speculators were willing to sell May and July futures at prices less than the current cash prices. That a "price of storage" seriously influenced either group seems doubtful.

ROLAND S. VAILE

University of Minnesota

PROBLEM RESEARCH

WHEN any group of economists gets together to discuss research, it is soon pointed out or definitely implied that the function of research is to help solve problems. As economics is a social science, reference is to social problems. A social problem is not just a difficulty; a social problem is that part of a confused or troublesome social situation which, if understood and straightened out, will remove part or the whole of the difficulty. In briefest terms, a problem is the limiting factor or is blocked action in clearing up a confused situation. Furthermore, a social problem is not really understood unless or until the fund of wisdom obtained by pooled knowledge or by investigation provides a basis for a logical evaluation of the consequences of alternative means of action that might be taken to correct it. If this is true, one of the main purposes of social research should be to understand and then to help to solve the core difficulty or to eliminate the confusion in a problematic situation.

The issues involved in a study of social problems may be concerned with only a few persons but this is very exceptional. Significant social problems generally involve conflicts of interest between groups or they involve major catastrophes. In either case individual action is likely to be ineffective. Indeed, Government has often become a necessary party to the solutions of such problems; witness the situations in regard to price policies, marketing programs, and land resource problems in the field of agricultural economics. Social problems in such spheres of interest may be said generally to involve Government participation in their solution or amelioration.

By introducing Government influence into our economic life, it becomes necessary to have a much more through understanding of the probable effects of different programs on various groups than if changes were to take place through the normal working of the price system, as was manifest in the period when frontier individualism was the dominant force of change.

It is becoming more and more true that Government at some level must participate beyond the degree necessary to create a favorable environment for free competition. If Government is vitally concerned with, and a party to, major social problems, a question arises for the research worker: "What should be the nature of

problem research in an economy in which Government activity is participative?" In a brief exploration of this question, certain points will be stressed, qualifying statements will be omitted, and ideas will be presented in approximately categorical statements. The main point is to establish the validity of the central core of thought.

In the main, there are two broad aproaches to research problems: descriptive and analytical. Much of social science research deals with a descriptive or a statistical characterization of situations. No one would wish to speak disparagingly of the value of accurate descriptive material in forming judgments. The aim of research should be to supply data, information, and ideas so that individuals will be helped to make better judgments about significant situations than they could otherwise. But a description of a situation—including an analysis of interrelationships—may be superb in every respect and still not analyze the social problem or problems involved. For this there are several reasons. Factual descriptive statements are part of the information necessary to establish what a social problem really is; they help to define a problem by narrowing the area of controversy. But a lot of thinking—and a lot of work—needs to be done in the process of isolating problems clearly. And a genuine analysis of a problem requires that thought dig deeper than description and descriptive interpretation of interrelationships. Relationships between difficulties and solutions must be analyzed. Data have relevance or meaning for a problem only insofar as the classification and the analysis of the data are guided by hypotheses which specifically formulate the issues in the investigation. Social facts do not speak for themselves.

The strategic approach to a social problem often involves an analytical concentration on crucial aspects of economic processes impinging on problems. At times, however, problems can not be clearly formulated or for various reasons cannot be studied; and economic process research is not only essential but significant in that greater knowledge of economic forces at work do influence the solution of problems.

Some change or movement in the prevailing situation will be necessary if conflicts of interest in a problem situation are to be overcome. Otherwise there is no social problem. But if there is a problem, we do not understand it until we know what changes will be effective.

Consequently, problem research should be directed to those issues about which more information is needed before judgments on planning and policy programs can be safely formulated. Social facts must be relative to change or action. In the field of agricultural economics, to spend millions on action programs and to undertake changes in policies and programs without adequate investigation of past experiences and research on cause and effect analysis is not only wasteful; it is running blind. Conversely, to conduct research, which purports to deal with social problems, without relating it to economic or institutional changes that are apparently needed, is virtually to assure sterile investigations. When economists take on the role of problem research workers they must of necessity become broad-guaged social scientists.

It is often dangerous to be a social scientist. But if economists are to deal with social problems in this day and age, it is hard to see how they can avoid giving more consideration to public interests in major issues than is now being done. Our democracy, born of free land and strong in individual self-interest, has undergone a change as group action has increased in the control and expansion of individual action. The economist's responsibility for studying public policies and programs has correspondingly increased.

The job is difficult. The very best research methods and techniques of investigation should be employed in social problem research. Problem analysis should give impetus to a revitalization of investigational techniques and a challenge and stimulation to research workers.

The task of studying social problems objectively calls for men with an ability to refrain from pleading special causes, even if the evidence and the research point to a single solution. The economist's task is first to isolate and clearly state the problem and then to present the best possible research results and evidence on the cause-and-effect or means-consequence relationships that would be involved in alternative courses of, action and thus to widen the basis for value judgments in regard to programs or policies for improvement. To do this well and to state the facts clearly, particularly when they and the conclusions they point to are not especially favorable to established policy, calls for statesmanship.

V. WEBSTER JOHNSON

Bureau of Agricultural Economics

RELATIONSHIP OF LAND VALUES TO WARRANTED VALUES, 1910–48

A RECENT report by the Bureau of Agricultural Economics[1] showed that land values for the Nation as a whole and for many areas have continued to rise. Yet there is general recognition that, barring some very unusual developments such as war, the economy may be rapidly approaching a period of lower prices. This feeling received further support in the early months of 1948 when the prices of certain major agricultural commodities broke dramatically from admittedly peak levels. Security markets were extremely uneasy, bond prices in particular weakened, the stock market was unfavorable for new issues, interest rates and yields strengthened, and long-term credit tightened. On top of these, reports on production of agricultural commodities, both domestic and foreign, were very favorable and demands, particularly foreign demands, were being modified by acute dollar shortages. Implication of these developments have led potential buyers of farms as well as agricultural lenders to look again at current values of farm land and to wonder whether future net incomes from land are likely to justify the current prices of land.

Few will deny the importance of future incomes in appraising the current value of a farm for purchase or in establishing the amount which can safely be loaned on a farm. For loan purposes, future incomes must largely be relied upon for interest and principal payments. When buying a farm, the owner must also depend on future net land incomes for a return on his investment. Yet it is common knowledge that in the past land values have reflected future income to only a minor degree. Admittedly, it is extremely difficult to arrive at an accurate forecast of future net land incomes, and the proper capitalization rates are very elusive. But from an over-all policy standpoint it would appear that, purely as an abstraction, an examination of past relationships between the trend of actual land values. and a warranted value based upon certain rough assumptions as to capitalized net rents might bring out some principles which would prove useful.

To develop a working hypothesis of warranted values for the

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[1] "*Current Developments in the Farm Real Estate Market*," U. S. Bur. Agr. Econ., April 1948 (processed).

period 1910–48 to compare with the actual trend and levels of land values, two principal assumptions have been made:

1. That the capitalization rate would approximate the average interest rate on outstanding farm-mortgage loans, plus 1 percent.
2. That for any year the warranted value would be the capitalized actual net rents for the 10 years following, plus the capitalized average (1910–48) net rents for the entire period beyond 10 years to infinity.

The Bureau's series on net rents and land values were used.

TABLE 1. METHOD OF ESTABLISHING WARRANTED VALUES OF FARM LAND PER ACRE

Year	Net rent per acre	Average interest rate plus 1%	Present value of net rent for each succeeding year for 10 years			Average net rent ($4.06) ÷capitalization[1] rate	Present value of average net rent for 10 years	Warranted value per acre Col. 6 − Col. 7 +Col. 3, 4, or 5
			@.070	@.070	@.071			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(Dollars	*Percent*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1910	2.52	7.0	25.66[2]			58.00	28.52[4]	55.14
1911	2.52	7.0	2.36[2]	26.44[2]		58.00	28.52	55.92
1912	2.62	7.1	2.29	2.45	27.29[2]	57.18	28.38	56.09
1913	2.62	7.1	2.14	2.29	2.45	57.18	28.38	56.09
1914	2.69	7.1	2.05	2.20	2.35			
1915	3.00	7.1	2.14	2.29	2.44			
1916	3.84	7.2	2.56	2.74	2.92			
1917	5.61	7.1	3.49	3.74	3.98			
1918	5.83	7.1	3.59	3.63	3.86			
1919	6.06	7.1	3.30	3.53	3.75			
1920	3.82	7.1	1.94	2.08	2.21			
1921	2.94	7.2		1.49	1.59			
1922	3.46				1.74			

[1] Average net rent over the period 1910–48 = $4.06.
[2] Sum of the present values for the following 10 years.
[3] Formula for determining present value $v^n = \frac{r}{(1+i)^n}$ where v = present value, r = net rent, n = number of years.
[4] Formula for determining the present value of an annual return $= a_n = \frac{r(1-v^n)}{i}$.

Table 1 which follows shows the method of arriving at the warranted value for 1910, 1911, and 1912. The same method was used for each succeeding year (fig. 1). In essence, this method of calculating the warranted value assumes that for any particular date a buyer had perfect foresight as to the net rents for the immediate following 10 years and that he knew that net rents beyond 10 years to infinity would be the average net rents per acre for the 38 years 1910–48. These net rents are interpreted into present terms on the basis of the interest rate on outstanding mortgages at that time plus 1 percent.

Assumptions Discussed

These assumptions are not intended to be entirely realistic. They are set up to see whether any generalizations can be drawn from the relative movements of warranted values based on the above assumptions and of actual land values from 1910 to 1948, on the basis of perfect foresight as to net rents. Different assumptions, of course, would lead to differeent relationships.

Capitalization rate.—Many will argue that the interest rate on

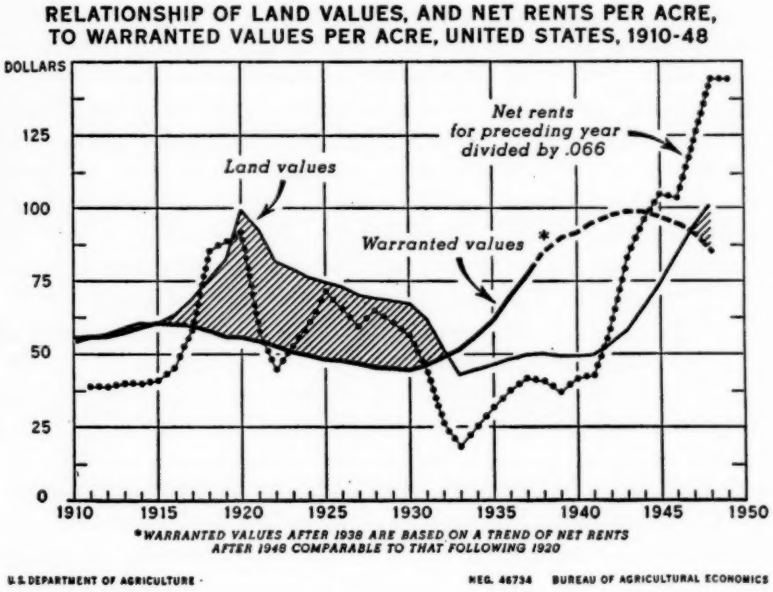

FIG. 1

mortgages plus 1 percent is not a good rate at which to capitalize net rents. They will point to the tendency of net rents to be a larger proportion of land values than has been true in the past, as evidence of a much higher capitalization rate. Average interest rates on farm mortgages, on the other hand, are 20 percent or more lower than at any time during the first three decades. Up to 1933 interest rates fluctuated mildly between 6.0 percent and 6.4 percent. Between 1933 and 1944 they declined to 4.4 percent and have since strengthened to about 4.7. Because of the general rise in interest rates and yield in recent months and because of a shift in

farm-mortgage debt from lower-rate lenders to higher-rate lenders, the average rate may edge upward still further in the next 10 years. To the extent that mortgage-interest rates increase in the future, warranted values after 1948 under the above assumptions would be at a lower level.

Influence of the trend in interest rates.—The decline in interest rates since 1924 and particularly since 1934 profoundly influenced the level of computed warranted values. If the capitalization rate had been assumed to be constant, based on the average level which prevailed over the entire period, warranted values in the earlier period would have been substantially higher and in the more recent years they would have been 15 percent or more lower. Thus the trend of warranted values would have been more nearly horizontal. This would have been more closely in accord with the fluctuations of land values to net rent. As a matter of fact, the relationship between net rents and land values might appear to indicate a very high capitalization rate all during the war period or that the extremely high net rents were not expected to continue for very long in the future. To have considered this relationship, however, as a reflection of a high capitalization rate would have invalidated the very comparisons which we were attempting to obtain. It would appear more likely that buyers expect future net rents to stabilize at a much lower level.

The mortgage-interest rate was used on the basis that it would reflect the trend of interest on riskless investments, in addition to the market's evaluation of a part of the risks of such equity holders in agriculture. A decline in average yields and returns probably should be reflected in the capitalization rate because of the alternative opportunities in other investment fields over a comparable term. The additional 1 percent was added to reflect the added risks to an owner that are not taken by a mortgage holder.

Few are likely to disagree with the assumption that the capitalization rate should exceed the mortgage-interest rate in order to account for the added risks of land ownership over that of a mortgage holder, but whether the differential should be 1 percent or more is open to question. Probably however, 1 percent is closer to a minimum than a maximum. Had a higher differential been used the general level of warranted values would have been somewhat less, particularly in the more recent years, because the declining trend in interest rates would have influenced the total capitaliza-

tion rate less. Such an assumption would also have increased the adverse relationship of warranted and actual values in the 1920's and it would decrease the relative favorability of the spread from 1930 to date. Use of the mortgage-interest rate would also reflect the actual interest rate which farmers would have to pay for the necessary credit to finance farm purchases. It would seem that, to the extent that such financing can be done on a long-term basis, the closer the interest rate plus a factor for risk, will approximate a reasonable capitalization rate.

As to the risk factor, there is good *a priori* reason for the assumption that the risk elements of physical production have been declining. New machinery has enabled farmers to get into the fields earlier and in weather and under soil conditions which were prohibitive with horse-drawn equipment. It also permits farmers to do jobs much more quickly and with greater efficiency. New varieties of disease- and drought-resistant crops are constantly introduced. Hybrid vigor is used to increase yield and production in both crops and livestock. Soil treatment is minimizing erosion and making long-term production more stable. This is not to say that farm income is more stable. Prices remain a major variable. However, government programs and cooperative efforts of farmers are making inroads on the most violent price fluctuations. It would therefore appear that both production and income risks are declining rather than increasing. This would tend to support the use of lower rates of capitalization in the more recent years rather than a higher rate based upon the current low relationship of net rents to land values. There would appear to be few reasons for an assumption based upon a much lower level of capitalization or for a greater rate of decline.

Capitalization of net rents for future 10 years.—The assumption that for any one year between 1910 and 1938 anyone had perfect foresight as to net land incomes for the succeeding 10 years is beyond support. There is, of course, the possibility of being able to forecast with in a fair degree of accuracy what such incomes will be a year or two ahead and what the probable trend will be for a number of years thereafter. In 1932–40, for instance, it is hardly probable that anyone would have forecast the momentous war increases in net rents, yet most would have expected higher net rents than prevailed in the period of the depression. Even if the net rents of the war period had not occurred it is still probable that warranted

values would have turned up at about the same time. But the extent of the rise would have been greatly modified. Certainly, in a period of marked inflation, it would not be impossible to predict a declining trend of future net land incomes. At the bottom of a depression it may be quite possible to predict higher net incomes. Because a larger proportion of the current value is capitalized out of the immediate future land incomes than out of far distant incomes, it was felt unnecessary to go beyond 10 years. When future incomes are capitalized at 7 percent interest, it is found that 6.5 percent is capitalized out of the net rent or income a year hence, 6.1 percent 2 years hence, 5.7 percent 3 years hence, etc., and about 46.2 percent of the current value or nearly half is capitalized out of the immediate future 10 years. Thus, although the assumption exaggerates the degree of precisions it would appear to provide the approach desired.

Capitalization of actual net rents over a period shorter than 10 years would tend to bring the fluctuations of warranted values near to those of net rents and land values, both in time and in magnitude.

The further assumption that the level of net rents beyond 10 years would be the average of the net rents during the entire period 1910–48 may be somewhat high for peacetime years, as the high net rents of both war periods are included. If the average net rents for peacetime years only had been used, greater emphasis would be given to the influence of the actual net rents during the first 10 years and less weight to the influence of the subsequent ones. Such an assumption would also have lowered the general level of warranted values. This might well be an assumption worth further consideration, for under the present assumption small changes in net rents even for considerable periods make little difference in the direction of warranted values.

Figure 1 shows the trend of land values as estimated by the Bureau and of warranted values based upon the assumptions discussed. The third line shows the current net rent capitalized at a constant interest rate of 6.5 percent which is the average interest rate on farm mortgages for the entire period, 1910–48, plus 1 percent. This line was put on the chart merely to place the fluctuations in net rents on a level comparable to actual and warranted land values. The mechanics of this operation was merely to divide the net rent for each year by 6.5 percent. The areas between war-

ranted and actual values are cross-hatched to show the relatively favorable and unfavorable periods for land purchase. The speculative return from buying land at a low price and selling at a high price or loss from buying at a high price and selling at a lower price has not been evaluated in arriving at warranted values.

This is not to say that it shouldn't be so evaluated, for a person who buys a farm at the peak of the cycle has little probability of selling it for more than he paid for it. In the course of 50 years he might have only one or two opportunities to sell for as much as he paid. On the other hand, one who buys at the bottom of the cycle has a very good probability of selling for more than he paid. The "equilibrium level" or the average value during a complete cycle would be the most probable value at which both farms could be sold; the one at a loss, the other at a profit. The amount is about halfway between the peak and the trough. On the basis of such an assumption the warranted current value could be either discounted or raised:—discounted by amortizing off the probable loss or raised by calculating the annuity necessary to equal the probable future profit. This would be the same process that is used to determine the net yield on bonds. The net rents could then be used to recapitalize into current values.

Warranted Values

Figure 1 indicates that between 1910 and 1915 actual land values and warranted land values based on the stated assumptions ran very close together. This was despite the fact that a considerable portion of that value reflects the high rentals of the war years which could have been only partially contemplated. After 1915 values of land continued to rise until 1920 even though in 1919 rents fell precipitously. No doubt a large proportion of this rise can be accounted for by expectations of speculative capital gains, but the last person to buy before the break was due for a rude awakening. The short rise in net rents following 1921 influenced warranted values very little, and the lower net rents from 1921 to 1931 resulted in a relatively continuous decline in warranted values from 1917 until 1931. During this entire period actual land values were unfavorable relative to what they had been in the prewar I era. Beginning in 1931, warranted values began to reflect the higher net rents after 1932 and rose abruptly after the effect of the high incomes of World War II began to be felt. Land values, how-

ever, showed little recovery until after net land incomes had been at unusually high levels for several years.

One of the factors responsible for the abrupt rise in warranted values after 1934 is the decline in interest rates in farm mortgages. This factor alone would account for 10 to 15 percent of this rise. As pointed out earlier, however, a distinct tendency for interest rates to strengthen is now evident. If they do so, the level of warranted values will again be decreased. To the extent that net rents fall in the future, warranted values should have reflected this expectation 2 or 3 years ago.

Should an assumption be made, for example, that net rents after 1948 would follow the approximate pattern of net rents after 1920, warranted values would reach a peak of about $100 an acre in 1943. The decline since then would be about $12 an acre which would place warranted values again below actual land values by approximately that amount. Such an assumption would not be overly pessimistic, as the level of net rents under such an assumption would be nearly 57 percent above that of the 1920's. Any assumption which would reduce the level of net rents beyond 1948 would, of course, lower warranted values and would likely have caused warranted values to have turned downward sometime before 1948. Unless, therefore, it is expected that net rents will be maintained at a relatively high level, it is a fair presumption that warranted values have already turned downward and that they are now or will be shortly, below current land values. To justify the current level of land values, net incomes in the next 10 years would have to average as high as in 1946, 3 times higher than the average from 1935–39, and nearly 10 percent higher than in the period 1940–44. The closer we approach a decline in net rents the more likely land values are to exceed a warranted value. It would appear from the figure that a change in warranted values precedes a change in land values by 3 to 4 years. Warranted values reached a peak in 1916, whereas land values didn't break until after 1920; warranted values started to rise in 1930, whereas actual land values did not increase until 1933.

Under the assumptions made it would appear that buyers are overly optimistic on the downswing of the land-value cycle and overly pessimistic on the upswing, although the period is not long enough to be by any means conclusive. However, support for this conclusion may be had from the influences which other assumptions

would have on this general relationship. Capitalization of actual net land income for a period of more than 10 years would have two principal effects: (1) The fluctuations would decrease in magnitude because the highs and lows of net rents would be further averaged out, and (2) the peaks and troughs of warranted values would even further precede the change in net rents and land values. If this were so, it would lead to the conclusion that extreme fluctuations in land values are seldom warranted. It does lend credence to an approach in land valuation which tends toward a normal value. But it also gives further support to those who feel that the normal-value concept is too rigid and that some account should be taken of an extremely favorable or unfavorable outlook that is immediate and short-run.

From a very casual glance at the trend of the average size of farm mortgages recorded it is also apparent that in the past they have followed very closely the general trend of land values. This would indicate that the amount of credit extended to farmers does not contemplate probable future incomes despite their importance in loan repayments. Such a conclusion was not unexpected, for all too little forecasting of future income expectations or future trends in land value gets into appraisal procedures. Lenders evidence considerable interest in the future outlook but the media of conduction into practical application meets considerable resistance, particularly when loanable funds are plentiful and the demand for investments is high.

Many readers who examine figure 1 are likely to conclude that the general trend of warranted values since 1910 is up and that such values in the future may be considerably higher than in the past. This may have some validity but probably not nearly the degree indicated. As previously mentioned, one reason for the high level of warranted values after 1934 has been the downward trend in the rate of interest. It will also be recalled that within recent years average interest rates on farm mortgages have edged upward and there are current indications that they may further strengthen. However, most students of the general money market feel that one effect of the huge national debt will be that governmental policy will be directed toward maintaining a relatively low interest-rate level. To the extent that farmers can obtain credit at relatively low interest rates there will be a tendency to capitalize them into higher values because less farm income will be required to service

the debt. Farmers may also be willing to take a smaller return on their investment because alternative investment opportunities are not so profitable. There is also a belief that modern equipment, new varieties of crops, Government farm programs, and many other factors tend to reduce the risk of farming. These lower risks may subsequently be capitalized into higher land values, with greater financial risks being accompanied by higher capital inputs and increased use of credit. Such a tendency, however, has not as yet become evident, as farm-mortgage debt has for all practical purposes decreased, continuously since 1923.

As with most assumptions based upon averages, these used here no doubt tend to obscure many variations in land values and net rents which are significant. During the World War II period in particular the land-value responses to high wartime prices have varied materially by regions and probably even more so by States and for individual farms. There may still be bargains where probable future land income would more than justify current asking prices. Land bought to round out an inefficient unit might still increase its productivity sufficiently to make it a justifiable purchase. But potential buyers or lenders should certainly take a second look under current and probable future conditions. In the past considerable time and effort has been extended to make everyone aware of the dangers of high land prices. It would appear in retrospect that some of these efforts may have been premature. But such efforts should not now be relaxed just at the time when the real dangers of land purchases at too high prices may be imminent.

HARALD C. LARSEN

Bureau of Agricultural Economics

PRICING OF PRODUCTION CREDIT TO FARMERS

THE thesis of this paper is that the geographically uniform rate of interest of the Production Credit System is not only politically necessary, but is an economically sound, realistic and equitable method of pricing production credit under certain limiting assumptions. As a corollary to this, it is argued that the uniform rate in conjunction with adequate loan service fees may be superior in several respects to methods of pricing production

credit to farmers in common use among private lending agencies, i.e., a schedule of interest charges modified by private negotiations.[1]

If all lending agencies making loans to farmers based their interest charges an the cost of extending credit, effective rates could be expected to vary with (1) the cost of the loanable funds to lending institutions, (2) the costs of making and servicing loans to farmers, and (3) the estimated risk inherent in loans. According to a recent study of the structure of interest rates on commercial bank loans to farmers,[2] it appears that loan service costs account for nearly all of the total variations in interest rates among borrowers and by regions. Commercial banks generally do not assess their borrowers any fees, but instead charge varying simple rates of interest depending largely on the size of the loan.[3] This is an attempt to compensate, in a crude way, for differences in cost of servicing loans of different size relative to the size of the loan. Costs of service such as opening the account, examining the loan application, appraising the borrower, the security offered and his financial prospects and history, making collections and recording a mortgage, vary only slightly with the amount of the loan. Therefore, if the principles of pricing credit according to costs of service is adhered to, these costs should be assessed in the form of a schedule of fees based on accurate cost accounting estimates of the true cost of service. With this method, a schedule of interest rates is unnecessary and loan service fees plus a single rate of interest on all loans constitute a more realistic, accurate and equitable effective interest charge. We can conclude, therefore, that the Production Credit Associations are using a sound, and probably superior, method of pricing production credit to their borrowers than are private lending agencies, provided that their loan service fees are based on accurate accounting estimates of costs of service.[4]

[1] The geographically uniform rate of interest of the Production Credit System has been attacked not infrequently by students of farm credit theory and policy and by representatives of private banking interests on the grounds that it is uneconomic, unrealistic and inequitable. Agreement, however, is general that it is a matter of political realism that at least the contractual rate to farmer-borrowers of the PCA's cannot be other than geographically uniform. See, for example; Earl L. Butz, *The Production Credit System for Farmers*, The Brookings Inst., Washington, D. C., 1944.

[2] Richard Youngdahl, "The Structure of Interest Rates on Commercial Bank Loans to Farmers," *Federal Reserve Bulletin*, Dec. 1947

[3] Banks, however, generally require a minimum interest charge of 50 cents to $1.50 on small, short-term loans.

[4] Whether the Associations levy these fees in accordance with accurate cost esti-

Relative to the variation in the interest rates on commercial bank loans to farmers due to the size of the loan, other causes of the differences appear minor as among banks, farmers and regions.[5] Among the more important of these minor factors is the imperfection in the market for production loans which appears to be composed of many small markets each with its own pattern of rates. In the farm mortgage loan market, the structure of rates appears to have a high degree of uniformity throughout the banking system reflecting both the national character of the market and the greater degree of standardization of the commodity. In terms, then, of costs of funds to banks and general market conditions, variations in interest charges among banks of different size and financial strength and in different regions could be substantially reduced through standardization of production loans and through creation of a national rediscounting market for them. Under these conditions, a uniform rate of interest would prevail in the production credit market just as it does now (with due allowance for loan size) in the farm real estate mortgage market. The Production Credit System has attained this market perfection through the medium of the federal Intermediate Credit Banks which buy from the Associations all production credit notes of their members meeting the Banks' standards. These notes constitute the security for the Banks' debentures sold in the national money market. In this manner the cost of the funds to the Banks and to the Associations is the same irrespective of the region or the size of the association. A uniform contract rate of interest, therefore, is not only justifiable on this ground also, but is the direct result of perfecting the market for production loans.

Another portion of the variation in the structure of interest rates on production loans made by commercial banks appears to be due to regional differences in the risks inherent in the predominant type of agriculture of the region.[6] Obviously a uniform rate of interest is neither economically sound nor realistic under these conditions.

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mates is doubtful. Information relative to these costs and charges is inadequate and research is needed to improve the present basis of assessing these fees. Butz, *op. cit.*, pp. 52–57, indicates that the fees typically are based on the principal of the loan, decreasing percentagewise as the amount increases, except that some charges, such as mortgage recording, are assessed without reference to the terms of the loan.

[5] Youngdahl, *op. cit.*

[6] *Ibid.* Other very minor causes of rate differences reflect differences in the purpose of the loan, the security offered and the financial position and credit history of the borrower.

Production Credit Associations, being cooperatives, however, are able to adjust the uniform rate effectively through dividends to their member-borrowers. Associations with small losses can be expected to pay larger dividends (or add more to their members' equity in the Association) than those with large realized or anticipated losses. For this reason, the uniform rate of interest does not run counter to the principle of charging on the basis of cost. There is, however, a real question whether the present 3% margin permitted the Associations is adequate to permit a sufficient number of Associations to live within income derived from member sources and thereby (1) to allow the cooperative character of the Associations to reflect in full the regional differences in realized risk, and (2) to reduce the Federal subsidy to the System.[7]

In summary, the geographically uniform rate of interest of the Production Credit System is economically sound, realistic and equitable provided that certain conditions exist, namely (1) assessment of loan service fees according to accurate estimates of costs of service, (2) the perfection of the market for production credit instruments (notes), and (3) an interest margin sufficient to allow Associations to live within member incomes and thereby through the cooperative character of the Associations, to reflect fully to borrowers the regional and area differences in risks and operating efficiency. The System no doubt satisfies condition (2) but there is undoubtedly much room for improvement with respect to (1) and (3). Further research is needed in these areas for the purpose of determining appropriate production credit price policy.

NORRIS T. PRITCHARD

Iowa State College

[7] Butz, *op. cit.*, p. 91, favors a permissible margin of 5%, indicating that in 1943 relatively few associations required more than this amount to live within income from member sources. He also suggests that many Associations have by no means exhausted the revenue possibilities of loan service fees.

BOOK REVIEWS

Farm Accounting and Management, Ford Sturrock. London: Sir Isaac Pitman and Sons, 1947. Pp. xii, 211. 16 shillings.

Teachers, research workers, and other persons interested in farm accounting and farm management will find this book to be an interesting and valuable addition to their libraries. In addition to some new ideas, the book gives an idea of the methods used in applying accounts to farms in Britain. It will help to broaden the information of workers in the United States and to provide them with illustrative material.

This book is also of interest as a "first"—the first text book on farm management published in Britain. The first half of the book deals primarily with farm accounting. The remainder of the book deals largely with management problems of farmers, using accounts as the source of specific information about the individual farm.

Although the book was designed for use as a text, it will be useful in this country primarily as a reference book. The terminology used in Britain, the monetary units used, and the types of farming illustrated differ sufficiently from ours to confuse some students. The principles of accounting and management are the same for both countries, but many students are more apt to notice the differences in details than the similarities of principles.

The book is divided into four parts, each covering about fifty pages. Part I deals with the "Cash Analysis Method of Bookkeeping." It outlines the fundamental steps involved in keeping a record for a year and summarizing it to determine financial success. The author employs the interesting device of following the record of a farmer through three consecutive years. For the first year he presents a very simple form of a record, giving the principles of accounts without confusion of details. By summarizing the record at the end of the year and showing that this simple record will answer some questions but will leave others unanswered he then leads the reader through increasing complexities in the records of the next two years.

Part II covers "The Business Side of Farming." Here the author discusses banking and credit, the running of the farm office, and accounting problems involved for owner-occupiers and partnerships, and the problems of valuations. Part III covers "Accounts

as an Aid to Farm Management." The author discusses the use of various financial ratios as aids in evaluating the efficiency of operation of the farm. He also illustrates methods for estimating the probable financial effects of major and minor changes in the farm organization. Part IV covers "Enterprise Costs." The primary emphasis is upon the use of records to measure the efficiency of operation of the individual enterprises. Interwoven with this is a discussion of farm management principles involved.

The primary defect of this book is brevity. The fields of farm accounting and farm management are too large to be discussed fully in approximately two hundred pages. Many of the small details, particularly of accounting procedures, have been omitted; these details are frequently of great importance to the farmer who attempts to keep and analyze his own record.

S. A. ENGENE

University of Minnesota

A Critical Review of Research in Land Economics, Leonard A. Salter, Jr. Minneapolis: University of Minnesota Press, 1948. Pp. 253. $4.00.

This book should be read by every individual who has done, is doing, or contemplates research in any social science field. It is really a critical analysis of social science research techniques, with illustrations from rural land economics, and should have been so titled.

In his introduction (Chapter I) the author points out that the process of self-correction is a fundamental attribute of science, and that in newer fields the need for critical review is "more consciously felt." He might have more accurately added "and more definitely needed." Too frequently workers in new fields are prone to be oversensitive and on the defensive against criticism. There have been doubts, as the author indicates, as to the scientific statements of social science problems studied, and the adequacy of procedures used. The volume is an attempt to clarify concepts in social science research with illustrations from the field of land economics, and to suggest ways of improving the quality of such research.

The history of rural land economics in the United States in Chapter II is briefly sketched and helps define the problems to which research has been applied and the methodological concepts of the researchers who did the work. Chapter III explores the

meaning and implications of scientific method. In this chapter the author makes a contribution toward the better understanding of scientific method and its use in social science research. This chapter is really the heart of the book and could be profitably studied by graduate students in the social sciences.

This reviewer has taught courses in social science research methodology and has used a great many references, including most of those cited by the author in Chapter III. But Salter has pointed up this whole field in a way which had not been done previously. The 1928 handbook on "*Research Method and Procedure in Agricultural Economics*" indicated awareness of the inadequacies of the Pearsonian concept of science and the confusions resulting from a failure to overcome these deficiencies. Careful logical analysis of the problem and the desirability of deductive, qualitative analysis before large quantities of quantitative facts are obtained for classification and summarization were stressed, with the import that the heart of science is the "collection, summarizing, analysis, judgment, and presentation of numerical data of mass phenomena." While numerous workers since 1928 have attacked one phase or another of social science research methodology, there has not been any complete, over-all attempt to formulate a more adequate definition and procedure. It is here that Salter makes a thorough attempt and, this reviewer believes, at least a partially successful one.

Salter's thesis is that "confusions, conflicts, and doubts have been accentuated by failure to see the essential characteristic of modern science—of the experimental method of knowing. . . . Social scientists have not generally noted the source and solution of problems in means-consequence relations, the importance of problem formulation, the interpretation of hypotheses as tentative modes of solution, the functional correspondence of ideas and operations, the suggestive role of generalizations, and the critical characteristic of experimental testing as that of producing a process of interaction among the elements of the problem."

A brief appraisal is made of the various research methods that have been advanced including the experimental, the historical, the case, qualitative description, the analogical, the logical, and the statistical methods. Salter concludes that "if research is seen as a process of inquiry, with problems emanating from, and tested in, experience, with generalizations serving instrumentally to suggest

possible causative connections in experience, and with tests dependent upon such relations in the evidence of experience, . . . the techniques or devices previously held as constituting a scientific method turn out each to have a function to perform in the one task of processing evidence, in order to arrive at a proposed method of resolving an existing problem in experience."

The clear and concise discussion of over-all considerations that should be borne in mind in using research publications as methodological evidence (Chapter IV) is well done. Chapters V, VI, VII, and VIII describe and examine the weak and strong points of available studies in segmental fields of land economics, including land utilization research in the cutovers, the old highlands, subhumid regions, and other areas; research in landed property—landlord and tenant relations, land tenure, and land values; and research on the locational or tangible resource qualities of land. Because of the many subfields of land economics and the numerous publications and studies considered in each of these four chapters, the author's appraisals in many instances are sketchy and disappointing. Frequently, the author's sweeping generalizations of a large group of studies in a particular subfield overlook significant exceptions, and in some cases his generalizations are questionable for the majority of studies covered. Nevertheless, Salter's is the first comprehensive attempt at a critical appraisal of research in a field that has mushroomed during the past two decades and very much needed to be done.

The splendid grasp of social science research fundamentals and the broad understanding of scientific method which Salter possessed would have enabled him to make outstanding contributions in the field in which he worked had he been spared to live the customary span of years allowed most of us. But this study, which was his doctoral dissertation, should stimulate those who read it carefully, to do more effective research work in their chosen field. He was not content to point out the shortcomings of past research and indicate how the various studies could have been more reliable and useful, but recommends in his closing paragraphs these four major steps that should be taken in the future if social science research is to attain its maximum effectiveness: (1) *Adoption of a more comprehensive conception of social science inquiry.* "Research must be viewed in terms of its relevance to action." (2) *Recognition that research has its roots in problematic situations.* "It exists because of

conditions under which there is doubt as to what people should do because there is conflict between the purposes they are striving to achieve and the consequences they are experiencing." (3) *Encouragement of the functional use of hypotheses.* "Hypotheses are suggested alternatives lines of action that will lead to achievement of purposes." (4) *Recognition of the limitations and advantages of various forms of factual materials as evidence.* "The good in respect to evidence is to examine the full range of experience in which alternative lines of action have been tried. In this view, exceptional cases become not merely extremes to be cancelled out, but potentially useful proving grounds and potential sources of new suggestions."

R. R. RENNE

Montana State College

The American Individual Enterprise System: Its Nature, Evolution and Future, Vols. I and II. By the Economic Principles Commission of the National Association of Manufacturers. New York: McGraw-Hill Book Co., 1946. Pp. xiii, 1119. $10.00.

These two volumes are characterized in the foreword as an economics text. That they cannot successfully fulfill this function probably will be the judgment of most teachers. Because of the nature of the policy recommendations and the political influence of the National Association of Manufacturers, it can only be hoped that the contents of these volumes does not accurately reflect the views of the association with respect to economic policy. While some of the policy proposals are reasonable (in the opinion of this reviewer), the democracy in which the Economic Principles Commission professes belief would experience much difficulty in surviving if all of the policies which are suggested in these volumes were the bulwark of the U. S. economic framework.

Unlike either a systematic text constructed to aid in the reader's understanding of the way in which the economic system does or should function, or a tract designed to effectively sell a message to its readers, these volumes consist of a series of what appear to be separate monographs assembled without reference to any pedagogically useful system of classification. The "vital message for every red-blooded believer in American democracy" (refer to the dust jacket) is thus extremely difficult to piece together. The ar-

rangement is not unlike that which one might obtain by a random selection of the chapters in a standard "principles" text. Such an arrangement impairs the usefulness of any work as either a text or a propaganda instrument.

Bringing together professional economists (from universities and the business world) and businessmen to prepare a treatise describing the economic system and prescribing policy is a laudable idea. That academicians may make unrealistic assumptions—either through deliberate oversimplification or lack of knowledge about the "real" world—cannot be denied. However, the reader who is familiar with the writings of the members of the commission will question both the representativeness of the policy objectives usually espoused by these individuals as well as the relevance of their empirical observations. As one reviewer has remarked, "the scale of opinions . . . is effectively covered from A part way to B."[1] (In view of the conservative opinions of the authors, one might describe them as representative of the cross section from Z part way to Y.)

Proposed economic policy must be evaluated first of all in terms of the degree to which the objectives correspond to generally accepted goals. (For example, one would not consider seriously economic policy designed to minimize the size of the national income.) Even if the objectives are generally accepted, policy may be rejected because the prescribed techniques are not expected to be effective in attaining the professed objectives. The specification of techniques may rest on unwarranted empirical assumptions or upon an incomplete or inconsistent theoretical system.

Although at the broadest level, the policy objective espoused by the commission—maximum economic good for the American people—is generally accepted, examination of the Commission's definition of this objective reveals either rejection or omission of important intermediate objectives. Freedom of the individual to make his own choices is highlighted without consideration of the conditions under which a person is free. The optimum distribution of income is defined with reference to the notion that each individual receives (and should receive) what he contributes. There is inadequate recognition that there may be exploitation or that society is willing to modify (through taxation and public expendi-

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[1] See the review by Joe S. Bain in *The American Economic Review*, Vol. 38 (No. 1), page 153 (March, 1948).

ture) the distribution of income from that which would exist if incomes were determined solely by the pattern of resource ownership and resource prices.

The optimum allocation of resources—the intermediate objective toward which the bulk of this work appears to be directed—is inadequately defined. This is particularly apparent in the discussion of monopoly and competition (Chapter XII) in which it is espoused that "what is really contrary to public welfare is not monopoly itself, but conspiracy for restraint of trade" (p. 594). The notion of a maximum welfare condition as equality between marginal social cost and price (when there are no extra-buyer benefits attached to the good) has not been incorporated into the NAM's kit of economic principles. Further questions regarding the Commission's definition of a welfare maximum are presented in reading the discussion about resources used by government to produce things which could be produced by "individual enterprises." (Note pp. 714 ff.)

Concern is expressed regarding our ability to "maintain a system of peacetime production without a collapse of employment" (pp. 853–54), and accordingly 20 pages of these two volumes are devoted to a theory of business fluctuations together with policy recommendations for preventing collapse in employment. The causes of major fluctuations are set forth as (1) misuse or overextension of credit, (2) natural disasters, (3) broad disturbances of either economic or military character and (4) acts and policies of government. The significance of this last category is then supported by an analysis of the 1929 breakdown and the 1937–1938 decline. Policy recommendations include "A Specific Program for Government" notable for its omissions of both monetary and fiscal techniques as devices for influencing aggregate expenditure for goods and services. The major responsibility for stability in prices or employment is left to business firms. It is not necessary to point out that such a recommendation would receive little support from the bulk of economists and that a significant group of businessmen has avowed that the responsibility for this kind of stability must be accepted by the federal government.

The Commission's views with respect to agricultural policy are set forth in Chapter VI. A relatively low income elasticity for agricultural products as a whole together with the reluctance of farm people to move from agriculture is recognized as a major

factor contributing to an average per capita farm income that has been less than the average income for the economy as a whole. The strong dependence of agricultural welfare upon industrial welfare is indicated. Suggested policy measures to improve agricultural welfare confine government's role primarily to research, more adequate development of soil conservation and the provision of information. The Commission recommends that not only should government abandon price supports, but that it should also withdraw from the field of agricultural credit.

If one can detect a major thread in these two volumes it seems to be the maintenance of "freedom"—a concept which has proven extremely difficult to define precisely. Nearly every point of discussion eventually focuses around "freedom" and a reiteration of the Commission's notions of what is necessary to achieve it. Apparently what the Economic Principles Commission means by "freedom" is political freedom and "free choice" in the sale of resources and the purchase of products. This "freedom" together with an optimum allocation of resources (defined broadly enough to include economic progress) would constitute primary planks in a platform for a liberal economic policy. But most liberals would assert that the conditions necessary to achieve these objectives comprise something other than preventing business from conspiring to raise prices, good credit policy and a retraction of government activity in taxing and spending.

O. H. BROWNLEE

Carnegie Institute of Technology

Open Markets, Vernon A. Mund. New York: Harper & Brothers, 1948. Pp. xi, 264. $3.00.

The study upon which this book is based was started by Professor Mund while on a Social Science Research Council post doctoral fellowship, in the year 1940–41. In addition to investigating published books, government documents, and the like, Dr. Mund carried on extensive interviews on pricing methods and policies with executives in many leading industrial centers. He visited many of the organized markets and informal markets throughout the country.

Underlying his thinking is the idea that competitive marketing such as that under pure competition is preferable to monopolistic

competition which generally exists. To secure some added degree of competition in markets Dr. Mund feels that "Open Markets" are desirable. Open markets are those " . . . in which there is (1) a centralization of the forces of demand and supply, (2) the making of transactions openly and publicly, and (3) the right of all persons to buy and sell." (Page ix.) The rise and decline of open markets are shown historically for both Europe and the United States in the first three-quarters of the book. By this historical presentation, Dr. Mund shows not only the factors responsible for the coming and going of open or competitive markets but also suggests the possibilities for bringing about these open markets in our economy. The basis for his solution or suggestions is, therefore, the historical treatment.

There are some examples of open markets among the medieval European markets of the period 800 to 1500, which developed at local points for the exchange of surpluses of monasteries, estates, and others. Those which developed did have some competitive characteristics. An attempt was made to concentrate all trading among groups of buyers and sellers by restricting trade to specific places and times. Added restrictions tended to focus all trading in them—such as regulations against forestalling, engrossing and regrating. A decline set in with monopolistic practices near the end of the 15th century. Forestalling became the general practice and by 1700 had ". . . weakened or brought to an end the open markets in England." (Page 65.) Mund states that "The underlying reason for the gradual breakdown of the market system in England during and after the fifteenth century, however, was the fact that the gilds and companies had become effective monopolies with continuing interest in avoiding competition." (Page 67.) This breakdown was followed by the giving of special privileges to various individuals and groups for the carrying on of trade.

A relatively similar development occurred also in the market for agricultural labor in England. Through the use of hiring fairs which were annual events, employers would hire the help they needed. Again, there was opposition to this type of open market.

In the United States, open markets developed at an early date. Commonly in colonial America one of the first duties of local government was to establish town markets in which forestalling was forbidden. (Page 111.) Exchanges for agricultural, as well as other products, were established for trading in spot, to-arrive and futures

contracts. Other markets quickly developed, both local and terminal, for other commodities. Most of these markets were competitive in nature in that large numbers of buyers and sellers were represented in transactions of the markets.

In United States industry there are some vivid examples of (1) the creation of open markets, and (2) their breakdown with a return to monopolistic practices. With the added concentration of control and the resulting price control in the iron and steel industry the major manufacturers sought to prevent supplies from going to dealers and other merchandisers. The effort was made to market more directly from producer to consumer and not permit an open market for the commodities handled. Mund states, "The fact was that the iron and steel industry was rapidly becoming organized into pools and combinations which preferred to destroy markets in order better to control prices in their own interest." (Page 140.)

Mund states, "The general pattern of the disappearance of organized markets with the rise of combinations is the same in the various industries. In each instance, combinations have adopted policies which restrict or completely prevent market activity. These policies include concerted action on price, direct buying (forestalling), sales to consumers alone, sales at delivered prices only, prohibitions on resale, limited forward deliveries, and output curtailment." (Page 204.) Mund quotes Myron W. Watkins in bringing out the point that the activities of combinations have likely increased business fluctuations. (Page 224.) In commenting on the research done by large combinations he states that most of it is not of the fundamental type benefiting society but mainly is directed at maintaining the position which the firm has.

Market rules will continue to be needed if capitalism is to continue to exist. Consequently the national economy must take an active part in the creation and maintenance of open markets for basic agricultural and industrial commodities, and not have only the negative regulations of the past. As aids to the development of open markets, developments in the following fields will aid: (1) added information about prices and market news, and (2) the greater use of standardization of products.

The reviewer is impressed by the scholarly workmanship in the study. Several general questions arise which perhaps could not be handled in the investigation, but are nevertheless related to it. Do we know that competition is the best means to the end of social

welfare, or are there some other possible alternatives? If it is decided that a change to open markets should be made, can we, from a practical point of view, make that change now? The author has indicated ways in which he thought changes might be brought about but there might be more difficulties than now seem present. If it is decided open markets are desirable, may they be obtained in other ways than those suggested? In some agricultural industries now having conditions approximating open markets there is some question of the degree of competition existing. It may be entirely possible that these open markets might be developed on a decentralized basis, in terms of places where buyers, sellers, and supplies may be. The reviewer agrees with the writer that there is need for the centralization of price determining forces such as might be increasingly brought about by greatly improved market news, standardization carried through to the consumer, checks on monopolistic practices, and positive action in favor of open markets.

The reviewer would like to recommend very highly the book to all students and workers in economics, particularly those in the field of marketing, and also to those concerned with economic policy—as policy makers or administrators. So seldom do scholarly works of this nature appear that extra attention needs to be directed toward them and more encouragement given to other writers willing to do thorough jobs in the fields related to marketing.

ADLOWE L. LARSON

Okla. Agricultural and Mechanical College

America's Sheep Trails: History, Personalities, Edward N. Wentworth. Ames: The Iowa State College Press, 1948. Pp. xxii, 667. $7.00.

The innocence of Mr. Wentworth's title covers a compendious history of the sheep industry in the United States. Its great bulk includes chapters on every aspect of the industry, some of them inevitably repetitious, and the prospect for the reader is dismaying until he realizes the completeness and solidity of every part. Thereafter he can relax and enjoy the monumental learning, seasoned judgment, and sprightly writing that makes any chosen portion a delight. The author has not added to his burdens the hatching of any intellectual eaglet to fly over the story of sheep and symbolize some imagined deep relationship between wool and mutton and the

fate of this republic. The sheep and their shepherds stand on their own feet with most satisfactory results.

Mr. Wentworth begins with a prologue on the antiquities of sheep and demonstrates from the beginning a most admirable acquaintance with the broad stream of human history. Any exceptions to the factual frame work of his history hardly affect its reference to his particular subject. At all times this livestock specialty is seen in a reasonable proportion to the other activities of society. In its factual accuracy and completeness it appears to be equally reliable. The author's references to Wisconsin, as to which this reviewer was able to check him closely, demonstrated a real familiarity with his sources. He is perhaps mistaken to have overlooked the work of Professor Frank Kleinheinz of the University of Wisconsin, but the leading sheepmen are identified and their influence weighed. In general he has avoided judgment on the work of the Agricultural Experiment Stations.

It is perhaps inevitable that Mr. Wentworth's long connection with the industry as a member of the staff of the Armour Livestock Bureau would lead him to search for the creative sparks among the breeders and managers. He is inclined to be less tolerant of the errors of the staffs of governmental agencies than of those of the men he has come to know so well. But he makes his points in his criticisms of our land policies in their denial of a sound economic basis to grazing industries and of conservation policies in their sentimental regard for wild life and the native landscape. Beyond this, he acknowledges progress that has been made to place sheep- and cattlemen in a practicable position in our economy. It is not going too far to add in justification of his classical individualism that the burden of proof still lies on those who claim that philosophers and politicians have made good a claim to be trusted with any unchecked control of our commonwealth. This volume makes a good case for the judgment and inventiveness of a great number of men connected with the sheep industry, and one of its virtues is that it does not ignore individuals in favor of generalizations on the behavior of "masses"—except of sheep.

Among the most informative of the sections of *Sheep Trails* are those on "Financing the Sheep Business" and "The Public Lands." Both afford a review of important aspects of our economy in the light of specific experience.

W. H. Glover

State Historical Society of Wisconsin

Land Economics, Ronald R. Renne. New York: Harper and Brothers, 1947, Pp. xiv, 736. $5.00.

"Land Economics" is obviously designed as a text for an introductory course in land economics, and any person giving such a course should see President Renne's book. He has brought together in a volume of 736 pages many statistics and most of the important concepts of land economics.

The book includes 19 chapters divided into five major parts. Part I consists of a short chapter entitled "The Field of Land Economics." In it, several definitions of land economics are given, placing the focus of land economics on (1) the institution of property in land, (2) economic problems of land utilization, and (3) the social aspects of land utilization. Part II is entitled "Principles of Land Utilization." The chapter on "The Supply of Land" deals with the methods of increasing land supply and with land classification. The chapter entitled "Demand for Land" discusses population and its relation to land resources, and is one of the best chapters in the book. The chapter on land appropriation deals with property in land—its nature, evolution, and social control. Chapter V, "Economic Processes in Land Utilization," contains a brief description of current marginal analysis concepts, including indifference curves and the influence of monopolies. Included is a rather standard treatment of the principles of comparative advantage. The chapter on rent and income distribution is only 19 pages long. After briefly discussing Ricardian rent theory, Renne concludes: "The increasing tendency of modern economists to explain rent in terms of fundamental demand-supply relationships through marginal productivity and opportunity cost is a great improvement over earlier rent theories." This chapter also includes a discussion of the capitalization of rent into land values.

Part III contains a chapter on each of the major land uses: agricultural land, forest land, recreational land, mineral resources, transportation, and urban land. Renne justifies the treatment of transportation as a major land use by the fact that sizeable areas of land are used for highways and railroads, and also because transportation facilities play such an important part in the determination of land use. The general pattern of these chapters is to present information on the supply of the resource in relation to need, then to describe the distinctive features of the use, and finally to forecast future land requirements. Part IV, entitled "Land Use Prob-

lems and Policies," contains chapters on land tenure and tenancy, land valuation and credit, land taxation, and conservation of land resources. Each of these chapters describes the nature of the problem, how it developed, and some of the policies, programs, and agencies which have been or can be used to alleviate the problem. The chapter on tenure and tenancy is centered around tenure in each of the major land uses, and considerable emphasis is placed on the problem of public vs. private ownership.

Part V, entitled "Planning and Control of Land Use," consists of two chapters, the first of which discusses the nature of the planning process and lists 11 traditional attitudes which must be changed if planning is to be successful. The concluding chapter, "Future Control of Land Use," consists of a description of the various lines of public and private action. These two chapters are probably the least satisfying of any in the book, largely because they are in general terms and are not integrated with the preceding chapters. The discussion of future controls is particularly disappointing since it is essentially backward-looking and merely describes programs already adopted and—in some cases—abandoned.

Mr Renne is to be commended for bringing together in one volume many of the best ideas and statistics from the recognized literature of the field. For example, he uses Zimmerman on world resources, Bunce on conservation, Notestein on population, Teele on reclamation, the president's Farm Tenancy report on tenure, and the National Resources Board report on land classification. The major limitation is that it gives the impression of a book written before the second World War. In too many instances, references are taken from the 1930's or before. For instance, in discussing the possibility of increasing the supply of land by more intensive use, Renne cites the value of produce from victory gardens in the first World War. The comparable program in the more recent war was on a much broader scale and the results were considerably more impressive. In another place, page 48, is a statement that two million acres have been covered by soil surveys; the source cited is a 1935 U.S.D.A. publication. The discussion of land use planning in Part V leaves one with the impression that it is the story of a currently active program, amended at the last moment by mention of the discontinuation of the program. The discussion of soil conservation districts is taken largely from the "standard act" of the 1930's and from press releases of the Soil Conservation

Service, rather than from the major U.S.D.A. technical publications describing the state enabling acts actually adopted and the experiences of districts operating under these acts.

The chapter and section headings are in the main challenging, and the plan of the book is probably well adapted to a course outline. As a book, however, strict adherence to a systematic outline results in a certain amount of repetition. The major land uses, for instance, are treated in separate chapters in Part III, but they are also given separate treatments in each of chapters 5, 14, 16, 17, and 19. President Renne's book, in several respects, is not up to expectations. Minor inconsistencies and careless wording occur often enough to shake one's confidence. For instance, on page 259, Renne says that agriculture is an industry with a slow capital turnover. On page 259, he says that capital turnover in agricultural land is faster than in urban land and states that it averages about four or five years. Again, on page 550, he says that agriculture has a slow capital turnover. Actually the capital turnover in agricultural land seems to have varied from more than 14 years in the 1930's to less than three years in the 1940's. In the section on zoning, Renne explains that before local governments can adopt zoning ordinances, authorization must be provided in a state enabling act, (page 141). In the following sentence, he says, "This is done because of the provisions of the Fourteenth Amendment to the federal Constitution" and so on. Actually, the necessity for an enabling act arises from the doctrine that the police power resides in the state unless it is specifically delegated to another level of government. The "due process" clause of the 14th Amendment applies in any exercise of the police power and has no particular significance in the connection quoted.

RAYMOND J. PENN

University of Wisconsin

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True, Rodney H. *Sketch of the History of the Philadelphia Society for Promoting Agriculture,* Prepared for the Celebration of the 150th Anniversary of its Foundation, 1939, Philadelphia Society for Promoting Agriculture. 228 pages.

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NEWS ITEMS

The Department of Agricultural Economics and Farm Management at the University of Maryland was recently reorganized and the name changed to the Department of Agricultural Economics and Marketing. This Department is now set up on a divisional basis, there being five divisions as follows: Division of Marketing, Division of State Department of Markets, Division of Taxation and Finance, Division of Farm Management, and Division of Land Economics. Not only is the State Department of Markets work set up in the new Department but all marketing work is given under the auspices of the Department. With the greatly increased curriculum and additions to the staff, students can specialize in particular fields of Agricultural Economics, such as Marketing.

Dr. R. W. Hoecker, formerly Agricultural Economist with the Bureau of Agricultural Economics, heads the Division of Marketing. Dr. H. L. Stier heads the Division of State Department of Markets. Other staff members in the Marketing Division are: Dr. G. M. Beal, formerly Agricultural Economist with the Bureau of Agricultural Economics, Mr. R. P Callaway, formerly Agricultural Economist with the Bureau of Agricultural Economics, Professor Cabell Shull of Cornell University, Mr. DeVoe Willard of Harvard University, and Professor H. D. Smith who had his undergraduate work at Bridgewater College and took his graduate work in the University of Maryland.

Bureau of Agricultural Economics personnel receiving citations for Superior Service Awards at the Award Assembly of the Department of Agriculture on May 17 included William F. Callander, for preparing and releasing basic crop and livestock statistics throughout the war and following food crisis period, often under difficult conditions, in such a manner as to maintain the confidence of farmers, administrators, and the general public alike; Karl A. Fox, for his part in the preparation of key reports relating to European recovery and American agriculture; R. D. Jennings, for his development of a method of evaluating feed supply—livestock production relationships; and Vivian M. Behenna and Viola E. Culbertson, for their contributions to statistical research and analysis. At the same assembly, Philip V. Cardon, Bureau of Plant Industry, Soils, and Agricultural Engineering, received a Distinguished Service Award, for outstanding service and exceptional leadership in the advancement of agricultural science.

A two-day session of seminars on uncertainty and research in agricultural economics was sponsored by the Agricultural Economics Research Group at The University of Chicago. Those attending included Carl Heisig, Division of Farm Management, BAE; Donald C. Horton and Lloyd Barber, Division of Agricultural Finance, BAE; O. H. Brownlee, Carnegie Institute of Technology; Clifford Hildreth, Iowa State College; Harold Halcrow, Montana State College; John Fulmer, University of Virginia; Jacab Marschak, Tjalling Koopmans, and Kenneth Arrow of the

Cowles Commission for Economic Research, The University of Chicago; and T. W. Schultz, W. H. Nicholls, Glenn Johnson, and D. Gale Johnson, of the University of Chicago.

Martin Abrahamsen, of North Carolina State College, taught at Cornell University during the summer.

George W. Abshier became a full-time staff member in the Department of Agricultural Economics, Purdue University, July 1, to work on grain and feed marketing with the Agricultural Experiment Station and the Agricultural Extension Service. Dr. Abshier completed his graduate studies at Purdue University in June 1948.

Raymond Bailey has been appointed Research Associate on the Rural Economics staff of Ohio State University.

Ralph L. Baker has been appointed assistant professor in marketing research and teaching at Iowa State College.

Elmer Baumer has been appointed Research Associate on the Rural Economics staff of Ohio State University.

Manning H. Becker has accepted a position as research assistant in the Department of Farm Management at Oregon State College.

Ivan R. Bierly resigned from his position as associate professor of farm management at Cornell University. He has joined the staff of the Farm Service Division, Cooperative G.L.F. Exchange, Ithaca, New York.

Everett E. Bierman, a graduate of Purdue University, has recently joined the staff of the Bureau of Agricultural Economics.

A. Kermit Birth was appointed assistant professor of marketing extension at the Pennsylvania State College. Mr. Birth is a graduate of Penn State. He obtained his masters degree in agricultural economics from the same institution. He will devote his time to work in the poultry and egg marketing field.

M. C. Bond, Extension Economist at Cornell, was on leave for April, May, and June to serve on a cooperative appointment with the Bureau of Agricultural Economics. He worked in Washington setting up projects under the Research and Marketing Act.

C. F. Bortfeld has been appointed associate professor of agricultural economics at Kansas State College. He will teach and conduct research in farm management.

Robert E. Branson has returned to the Bureau of Agricultural Economics from a year's graduate work at Harvard University.

William Bredo has been appointed Secretary of the New England Research Council on Agriculture and Marketing.

John M. Brewster has resigned from Kansas State College and joined the staff of the Production and Marketing Administration of the United States Department of Agriculture.

C. I. Brigham, dairy farmer of Blue Mounds, Wisconsin, a pioneer co-operator in the detailed cost-accounting work of the old Office of Farm Management, died in March of this year. The files of data sent in by Mr. Brigham during the years 1907 to 1917 are among those selected for a permanent collection to be housed in the National Archives, as they illustrate methods of research during the period of development. Mr. Brigham was a careful observer and a patient reporter.

D. A. Broadbent of the staff of the Department of Agricultural Economics, Utah State Agricultural College, returned on July 1 from the University of Illinois where he has been spending the past year in graduate work.

L. H. Brown, formerly at Michigan State College, joined the staff of the Halderman Farm Management Service at Wabash, Indiana, July 1, 1948.

Joe R. Campbell, who is completing his doctor's degree at Cornell, has accepted a position as associate professor of farm management at Texas A. & M.

Eugene H. Carter has recently been appointed as extension specialist in farm management at Michigan State College.

H. C. M. Case, Head of the Department of Agricultural Economics, University of Illinois, and Associate Professor L. H. Simerl of the same department spent a part of the second semester in Washington, D. C. advising the United States Senate Committee on Appropriations on matters in connection with the Agricultural Appropriation for 1948–1949.

Allen R. Clark has resigned from the research staff at Montana State College to register in the graduate school at Iowa State College.

Charles E. Clark, formerly with the Georgia Agricultural Extension Service, has been appointed farm management specialist in the North Carolina Agricultural Extension Service.

Willard Cochrane, formerly economist with FAO, has accepted a position as associate professor of economics and agricultural economics at The Pennsylvania State College. Dr. Cochrane's research will be in the Departmen of Agricultural Economics and Rural Sociology and his teaching in the Economics Department where he will offer courses in advanced economic theory.

H. E. Conklin, who completed his doctorate last January, was appointed assistant professor of land economics in the Department of Agricultural Economics at Cornell starting February 1.

Mabel Darroch, known to many members of the Association when she was secretary to Howard Tolley in the 1920's, died at Fort Wayne, Indiana on April 6 about a year after her retirement.

George H. Day and Florence Fogelson have recently transferred to the Bureau of Agricultural Economics from the Dairy Branch of the Production and Marketing Administration. Both are currently working on an R.M.A. project designed to secure more complete and more accurate measures, than had been possible heretofore, of the level of fluid milk and cream consumption for the country as a whole and, in such detail as the data will permit, for cities and states.

Raymond J. Doll, associate professor of agricultural economics, Kansas State College, received the Ph.D. degree in June from the University of Minnesota.

Dudley Duncan will join the staff of the Department of Agricultural Economics and Rural Sociology at The Pennsylvania State College. Mr. Duncan is completing his doctorate at the University of Chicago and will do teaching and research in the field of population.

Ralph Eastwood recently accepted a temporary appointment with the Farm Credit Administration.

Marvin Farrell, who has been studying at Harvard during the past two years, has been appointed to the staff of the Department of Agricultural Economics at Ontario Agricultural College, with the rank of assistant professor.

Clinton L. Folse, recently Head, Department of Social Studies, Union College, Kentucky, has been appointed first assistant in rural sociology research and lecturer in sociology at the University of Illinois.

John K. Galbraith has been appointed director of agricultural and marketing research at Harvard University, and lecturer in the Department of Economics. Most of his time will be devoted to directing the program of research in marketing that Harvard University has under contract with the Research and Marketing Administration.

Florence M. Hamilton, a member of the staff of the Bureau of Agricultural Economics, died suddenly on May 13. Mrs. Hamilton was an expert on wool. During the war and postwar years she had prepared the Department's "Wool Situation."

V. B. Hart was on leave from his duties as extension economist at Cornell from April 15 to June 15 to work as consultant with the Savings Bond Division of the U. S. Treasury.

William F. Henry has been promoted from instructor in farm management to assistant professor at the University of Connecticut.

F. F. Hill, Head of the Department of Agricultural Economics, at Cornell, is assisting in the direction of a research program in agricultural finance sponsored by the National Bureau of Economic Research. During the summer months he spent a considerable portion of his time in New York City working on the project.

F. F. Hill. Leland Spencer, L. C. Cunningham, T. M. Adams, C. W. Pierce, and Steward Johnson have been serving on the New York Milkshed Price Committee. This committee has been studying the problem of administrative pricing of Class I milk. Professor Hill is chairman of the committee.

C. Ray Hoglund, formerly extension specialist in farm management at South Dakota State College, was recently appointed as associate economist with the Bureau of Agricultural Economics, United States Department of Agriculture. He is on a cooperative appointment with the Michigan State College and is located with the farm management department of that institution.

T. N. Hurd, professor of farm labor at Cornell, recently returned to the campus after a six-month leave of absence, during which time he was executive secretary for the New York State Food Commission.

Edgar A. Hyer completed his Ph.D. at Cornell University last June. He has accepted a teaching and research position in farm management at Oregon State College.

Albert R. Johnson has transferred from the staff of the Bureau of Agricultural Economics to the Washington office of the Bureau of Reclamation.

Glenn L. Johnson has completed most of his graduate work towards the Ph.D. degree at the University of Chicago under a Social Science Research Council fellowship. He is resigning his position as agricultural economics statistician in the Division of Statistical and Historical Research, BAE, to become associate professor of farm economics at the University of Kentucky, and associate economist in the Kentucky Agricultural Experiment Station.

William F. Johnstone was appointed assistant professor of marketing extension at the Pennsylvania State College on May 1, 1948. Mr. Johnstone was formerly associated with *Progressive Farmer*. He is a graduate of the University of Kentucky and received a master's degree from the University of Illinois. Johnstone will specialize in market information.

Thomas K. Jones, formerly with the Veterans Administration in Rutledge, Tennessee, has been appointed farm management analyst with the North Carolina Agricultural Extension Service and Agricultural Experiment Station.

W. E. Keepper, professor of land economics, The Pennsylvania State

College, has been granted a year's sabbatical leave beginning July 1, 1948. He has received a grant-in-aid from the Department of State and will spend a year working with Dr. Julio O. Morales at the Inter-American Inst tute of Agricultural Sciences, Turrialba, Costa Rica.

M. M. Kelso, Montana State College, has presented to the eleven western states through the Western Agricultural Economics Research Council a suggested regional project on public land utilization and management.

William H. Nicholls has resigned his position as assistant professor of economics at the University of Chicago and Editor of the *Journal of Political Economy*. Effective October 1 he will join the faculty of Vanderbilt University as professor of economics. As part of a greatly expanded program in economics at Vanderbilt, made possible by a grant from the General Education Board, he will be responsible for the initiation of a sequence of graduate courses in agricultural economics, and the development of a research program in the agricultural economy of the South.

Richard A. King has joined the staff of the University of Connecticut. He holds the rank of assistant professor of agricultural economics and is engaged in poultry marketing research.

Dale A. Knight has been appointed assistant professor of agricultural economics at Kansas State College. He willl teach and conduct research in farm management.

Richard L. Kohls has joined the agricultural economics staff at Purdue University as an instructor in agricultural marketing. He had previously been awarded the master's degree at the University of Missouri, where he was an assistant instructor for the past two years.

Baldur H. Kristjanson, assistant professor of agricultural economics at North Dakota Agricultural College, was designated as a participant in the Land Tenure Workshop held in August at the Science Camp of the University of Wyoming, under the auspices of the Farm Foundation, Chicago.

Gerson Levin has resigned from the staff of the Bureau of Agricultural Economics to join a poultry and egg firm in southern California.

John N. Mahan, formerly with the Tennessee Valley Authority, has joined the staff of the Department of Agricultural Economics, North Carolina State College, as BAE representative on the regional milk marketing investigation.

Milton L. Manuel has taken leave of absence from Kansas State College to do graduate work at the University of Minnesota. Emery Castle has been appointed to replace Professor Manuel.

Douglas Marais has returned to his post in the Bureau of Agricultural Economics of the Union of South Africa after two years of study at Harvard University and receiving his degree of Doctor of Philosophy.

John H. McCoy has been appointed assistant professor of agricultural economics at Kansas State College.

Stanley Mehr recently transferred from the Bureau of Agricultural Economics to the Office of Foreign Agricultural Relations.

Earl Miller, who was formerly employed in the Bureau of Agricultural Economics and Bureau of Census, has been employed in the Division of Farm Taxation and Finance in the Department of Agricultural Economics and Marketing at the University of Maryland.

Joe R. Motheral, economist in rural life, Texas Agricultural Experiment Station, has been awarded a fellowship by the General Education Board. Mr. Motheral will enter the University of Wisconsin in the fall semester for graduate work.

Max Myers, associate professor of agricultural economics, South Dakota State College, has been granted a year's leave of absence effective in July 1948. He plans to use the period for graduate study at the University of Minnesota and at Cornell University.

Howard Parsons has returned to the U. S. Department of Agriculture, Bureau of Agricultural Economics, and will assist Dr. F. F. Elliott in his assignment as associate chief of the Bureau of Agricultural Economics, in charge of research.

Kenneth D. Peterson has been appointed extension economist—marketing, on the rural economics staff at Ohio State University.

Walter H. Pierce, associate professor in the Department of Agricultural Economics North Carolina State College, has returned to his duties after a year's leave of absence at the University of Minnesota where he has been pursuing graduate work in agricultural economics.

W. H. Pine has returned to Kansas State College as associate professor of agricultural economics after completing the requirements for the Ph.D. degree in June at the University of Minnesota.

Donald D. Pittman has transferred from the Washington staff of the Bureau of Agricultural Economics to the Office of the State Statistician at Columbia, Missouri.

Edgar Porsche, formerly with the Economic Bureau of the Civil Aeronautics Board has joined the staff of the Bureau of Agricultural Economics. His work will be in the field of demand and prices.

Harold F. Prindle has transferred from the Washington staff of the Bureau of Agricultural Economics to the Office of the State Statistician at Seattle, Washington.

Norris T. Pritchard joined the staff of Purdue University July 1 as as-

sistant professor or agricultural marketing, research. He formerly was an instructor of agricultural marketing at Iowa State College.

E. T. Ransom, who has been with the Cooperative G.L.F. Exchange, accepted a position with the Production and Marketing Administration in Washington effective July 1.

T. J. Reed, a staff member of the Bureau of Agricultural Economics stationed at the Statistical Laboratory, Iowa State College, has recently transferred to the Washington office where he will assist in the preparation and design of samples for various surveys conducted by the Bureau.

Harold M. Riley has been appointed instructor in agricultural economics at Kansas State College. He will assist Professor C. P. Wilson in livestock marketing.

Thomas C. M. Robinson, a member of the staff of the Bureau of Agricultural Economics, has returned from Abu Ghuraib, Iraq, where he taught a course in agricultural statistics to 39 employees of the Egyptian, Iraqi, Lebanese, and Syrian governments. The course was arranged and sponsored by the Food and Agriculture Organization of the United Nations. The second such course will begin in Mexico City in August or September.

Anthony S. Rojko has been engaged in a dairy research project undertaken cooperatively between the Bureau of Agricultural Economics and the University of Connecticut.

R. C. Ross, University of Illinois, has been granted leave for the second semester of 1948–1949. He plans to work on a textbook for the elementary course in agricultural economics which he has developed over the past several years.

Virgil Salera has been appointed associate professor at Iowa State College in international trade. A portion of his research will be devoted to foreign trade and farm products.

Theodore W. Schultz and D. Gale Johnson of the University of Chicago took an assignment from the War Department to reexamine the economic controls and policies in Germany, particularly as they affect food and agriculture. They worked out of Frankfort and Berlin for approximately six weeks, and returned to the United States in August.

Raymond C. Scott recently completed the requirements for his doctor's degree at Cornell University. He has accepted a position as assistant professor of marketing at Cornell. He will be working in extension on the "Food Information Service" program.

Stanley K. Seaver, assistant professor of agricultural economics, University of Connecticut, has been granted a sabbatical leave for graduate study.

H. E. Selby has transferred from the Bureau of Agricultural Economics at Berkeley to the Washington staff of the Agriculture Division, Bureau of the Census.

Harold E. Smith joined the staff at Purdue University July 1 as assistant professor of agricultural sociology, Agricultural Experiment Station and Agricultural Extension Service. During the past year Dr. Smith had been teaching general sociology and agricultural sociology at the University of Akron, Akron, Ohio.

Mervin G. Smith has joined the rural economics staff of Ohio State University as associate economist.

Herbert Spindler, who has been in the Boston Milk Market Administrator's Office, has been appointed assistant research professor in marketing, Agricultural Economics Department, University of Massachusetts.

C. L. Stewart, University of Illinois, plans to spend considerable time in Mexico during the summer of 1948, collecting material for a new course to be offered in 1948–1949 entitled The Agricultural Economics of Latin America. This is part of the work in the Latin American Area Studies being developed at the University of Illinois.

J. L. Tennant, Head, Department of Agricultural Economics, was presented with a bronze plaque at a dinner in Providence, on June 19, by the Rhode Island Agricultural Conference, in recognition of service to agriculture, 1928–1948. A fund of $1000 to be known as the J. L. Tennant Loan Fund for assistance to students in agriculture, particularly those majoring in agricultural economics at the college, was given by agricultural organizations, friends and former students.

Gerhard Tintner of Iowa State College is on leave of absence for the academic year 1948–49, while he is giving lectures and doing research in statistics at Cambridge University, England.

Alexander H. Turner completed this work for a master's degree at Cornell University in June. He has returned to his position as Director of Research in the Department of Cooperation in Saskatchewan.

Melvin L. Upchurch, formerly acting land use specialist at Oregon State College, has transferred to the Bureau of Agricultural Economics with headquarters at Berkeley.

Karl A. Vary was recently appointed as assistant professor in research in the Farm Management Department at the Michigan State College. Mr. Vary received his Ph.D. degree from Purdue University in June 1947. During the past year he has been employed as agricultural economist for the Federal Reserve Bank of San Francisco. Mr. Vary's major project will be a farm management study of forage crop production in Michigan.

Warren H. Vincent has recently been appointed as research assistant in

farm management at Michigan State College. His duties are to be in charge of the study of the costs and returns of the dairy enterprise in southeastern Michigan.

J. Douglas Wahn, during the past year has continued his graduate study at the University of Chicago. As of September 1 he will take over his new position as assistant professor of economics at the University of Manitoba.

George H. Walter, Bureau of Agricultural Economics, formerly stationed at Milwaukee, has joined the staff of the Washington office.

Donald J. Watson changed from instructor in agricultural economics at Purdue University to assistant instructor in agricultural economics at Cornell University July 1 where he will continue his graduate study.